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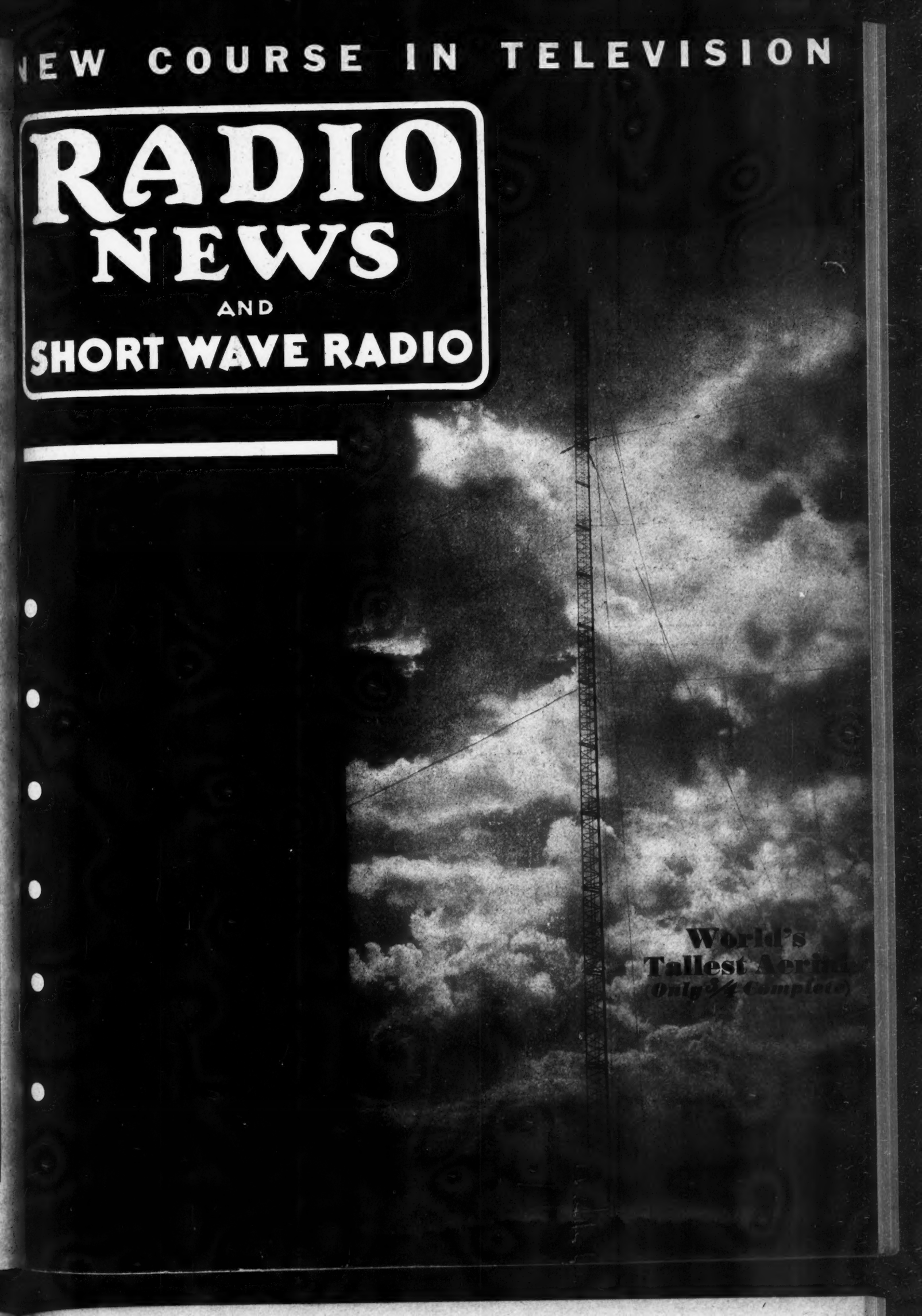
RADIO NEWS

AND

SHORT WAVE RADIO



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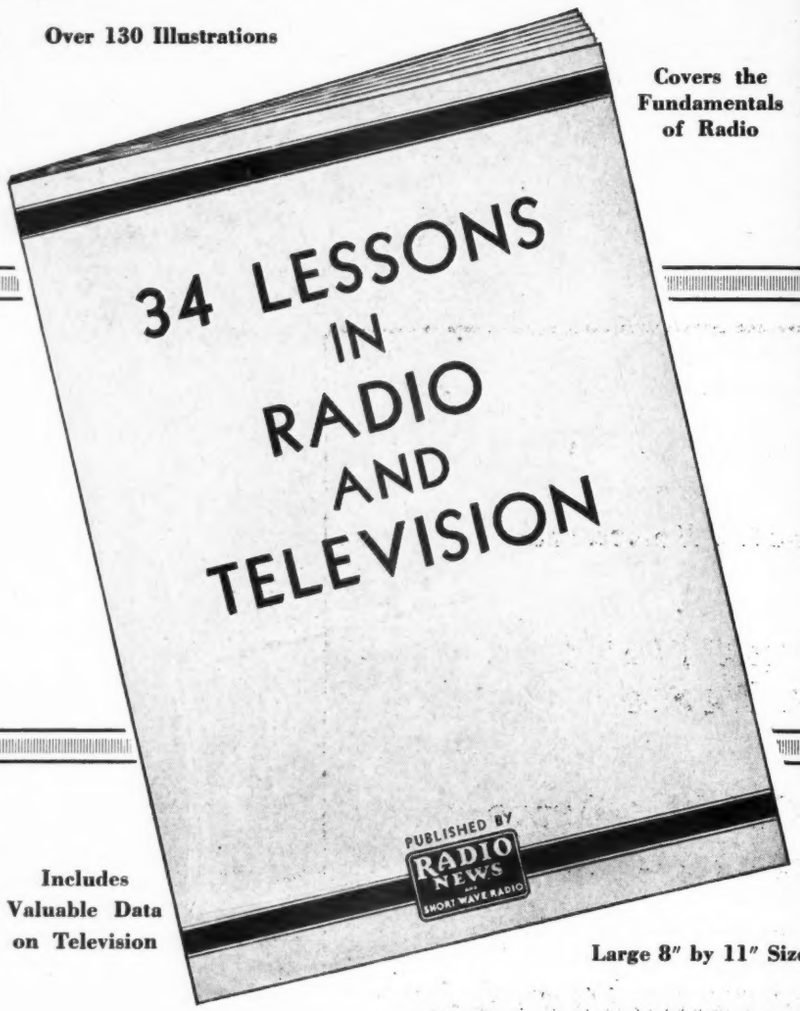

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List of Contents

"34 Lessons in Radio and Television" includes reprints of all installments of "The Radio Beginner" which appeared in RADIO NEWS from May, 1936, to June, 1937. Here is the complete list of contents: Fundamentals of Electricity—Vacuum Tubes—Reception of Radio Waves—Radio Symbols and Circuits—A Simple Diode (or Crystal) Receiver—Operation of Vacuum Tubes—Building a Simple Triode V. T. Receiver—Radio and Audio Frequency Amplification—A One-Stage Audio Amplifier—and How a Power Supply Works.

Also, Operation of an Audio Amplifier—Fidelity of Amplifiers—Building an Amplifier-Power Unit—Regeneration—Building a Two-Tube Regenerative Tuner—Operation of Pentode Tubes—Advantages of Pentodes—Simple Tuned R. F. Receiver—Discussion of T. R. F. and Superhets—A High-Quality Broadcast Receiver—Automatic Volume Control—Oscillators and Mixers—Facts About Antennas—Photocells—Breaking Into the Amateur Game—and Code Practice Oscillators.

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Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers, as much as $30, $50, $75 a week. Many Radio Experts own and operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay, see the world besides. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities. Television promises to open many good jobs soon. Men I trained are holding good jobs in these branches of Radio. Read their statements in my 64-page book. Mail the coupon.

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( ) Broadcasting Station Operator
( ) Aviation Radio Operator
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( ) Loud Speaker Systems, Installations and Service
( ) Auto Radio Installation and Service
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RADIO NEWS

Vol. XIX, January, 1938, No. 7

Reading Guide to this Issue—

AMATEURS—3, 6, 8, 9, 10, 11, 12, 17, 18, 20, 22, 24

BROADCAST FANS—2, 8, 13, 14, 17, 18, 22

DEALERS—1, 4, 5, 6, 8, 9, 11, 12, 16, 18, 22

DESIGNERS—6, 7, 8, 11, 18, 20, 22

DX FANS—2, 8, 13, 17, 18, 22, 23

ENGINEERS—6, 8, 11, 14, 18, 20, 22

EXPERIMENTERS—3, 4, 6, 7, 8, 11, 14, 17, 18, 20, 22

MANUFACTURERS—8, 18

OPERATORS—3, 8, 18, 20, 21

SERVICEMEN—1, 3, 4, 5, 6, 7, 8, 18, 20, 22

SET BUILDERS—3, 4, 6, 8, 9, 12, 17, 18, 20, 22

SHORT-WAVE FANS—8, 15, 16, 17, 18, 24

STUDENTS—1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 18, 19, 20, 22

TECHNICIANS—3, 6, 7, 8, 18, 20, 22

Next Month

ANOTHER development from the laboratory of Raymond P. Adams, on which constructional details will be presented in the February issue, takes the form of a high-fidelity receiver. Among its features are a 2-stage, variable band-pass t.r.f. amplifier; voltage-doubling diode detector; push-pull audio stages and 2A3's in the 12-watt output stage. This is the sort of design that many advanced constructors have been awaiting for use where high-quality reception from local broadcast stations is the important consideration.

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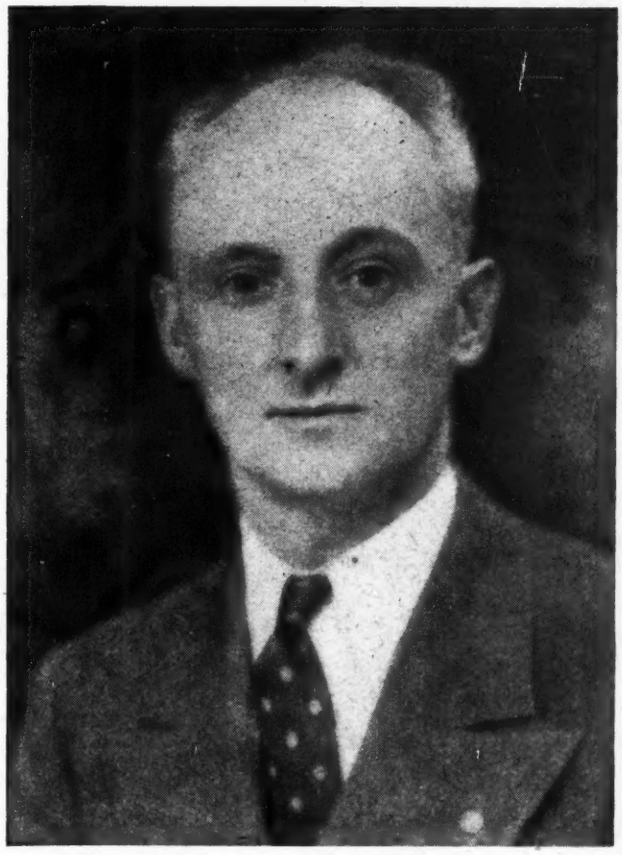

READ TO THE FAR CORNERS OF THE EARTH

"It is perfectly amazing to note some of the far corners of the earth to which your publication, RADIO NEWS, *is distributed and read. We are receiving inquiries, daily, from practically every country in the world where products such as ours are used and we find that the majority of them are from readers of* RADIO NEWS. *Our export business has been increasing every year, and while we feel that the quality of our products has a lot to do with this increase we know that we are indebted to your publication for bringing our products to the attention of our present customers in other lands."*

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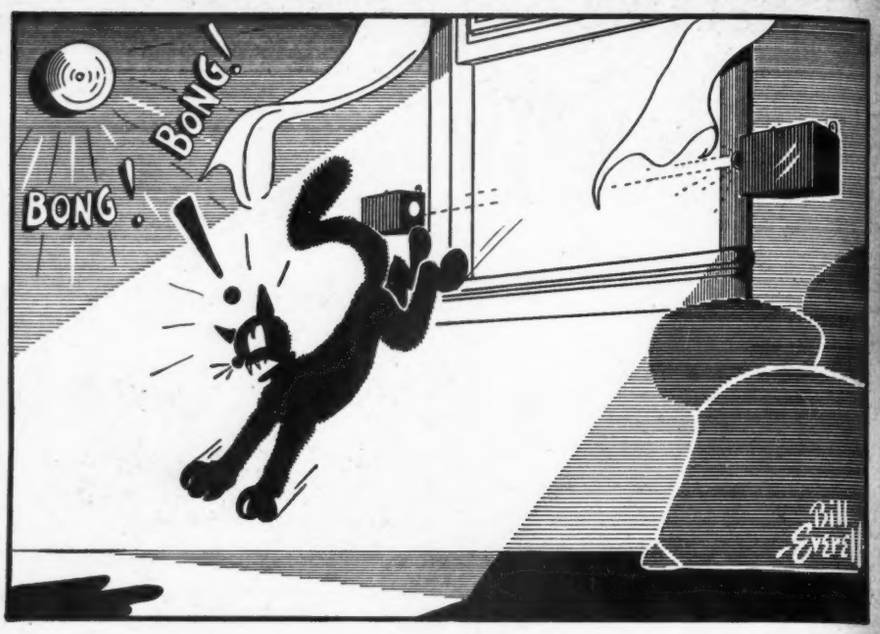
Pages From A Serviceman's DIARY



FELIX'S ARRIVAL WAS ALWAYS VERY WELL ANNOUNCED

The installation of photo-electric burglar alarms offers a new and substantial sideline for service-dealers, but don't make the mistake that one serviceman did. He installed a very fine system for a customer, not knowing that there was a cat in the family. The window was on the ground floor and Felix's arrival at 3 a. m. after a midnight stroll woke up the whole family with a burglar scare until they discovered that Felix was the "Midnight Marauder".

SATURDAY: Calls piled up rapidly this morning, all wanting service "pronto" so they can listen to the football games. About one-half the jobs will call for shop work so the only way we can keep the customers satisfied is to leave a set on loan while the defective ones are being fixed. Accordingly, I gathered together a few trade-in midgets, as well as new ones, and started out. Some of them, I hope, will stay put as extra sets. (Which won't be so bad for all concerned.)

Stopped at the doctor's home first, where the push-button switch on the old RAE-79 wouldn't operate the relay. Found the copper contacts on the relay badly burned so picked up the chassis for a shop repair. We'll put in double contacts on the repair and shunt the points with a condenser to keep down the sparking.

A Nervous Wife

The doctor's wife is a very nervous individual and worries a lot when the doctor is called out at night. They have two children and the house is in a rather lonely spot so perhaps she can't be criticized, since there have been a number of burglaries recently in this neighborhood. I mentioned our photo-cell burglar alarm, which rings a large bell and suggested that it be installed to operate when anyone tries to pass from the office to the living quarters. She seemed much interested and I arranged a demonstration on Monday at a time when the doctor would be home.

Next, a Stromberg 846. The middle-aged school teacher who met me at the door showed me a pair of pliers she had been using to turn the dial-drive shaft, which was binding badly. The tuning knob had been removed, since the inner spring had bent flat under the strain (no use trying to take the shaft apart to clean and lubricate it—a new one costs only sixty cents). Had it with me so made the replacement on the spot. Mentioned the burglar alarm to her too but—no go! She is unmarried and perhaps would welcome a visit—even a burglar. I imagine she looks under the bed every night before retiring to see if a man is hiding there.

Ran off a couple of tube replacement jobs, then returned to the shop for lunch.

Replaced a condenser in an old Majestic B eliminator, used with a discarded battery set in the servant's quarters of one of the larger homes near the shop. This was promised for the afternoon so I had to drop it off. They'd be a lot better off to get another set. But some like to hang on to these decrepit old machines, remembering the high original cost and feeling that therefore the performance must be superior to the cheaper new sets. Some, also, get so accustomed to bad reception that they can't appreciate a really good set.

Noisy Volume Control

Moved on to a Radiola 48 which was acting up again. We'd installed a new volume control about a year ago. Time flies for customers, though, and the owner had to be shown our record card in order to be convinced that the job had been done more than three months previously. The cadmium plating had begun to flake off the gang condenser, creating a raspy noise when tuning. This trouble hadn't been present before but perhaps we should have given it a treatment on general principles. We disconnect all leads from the variable condenser and then apply 600 volts between each stator assembly and ground, with the stator plates meshed. This burns off any projecting burrs which may be present.

Cut the price for the job to a minimum, left a set on loan and went to the next sufferer. This proved to be one of the bronze-finished Fada models, equipped with a neon-tube resonance indicator. The Italian woman who owned it could not be termed a stylish-stout. She was so fat that she actually created a draft as she sailed into the room, with several dirty-faced youngsters peering from behind her skirts.

Resonance Indicators

The neon-tube wouldn't light—therefore it must be burned out, she was certain. Unfortunately, these resonance indicators have a disgustingly long life from the serviceman's standpoint. I pulled out the chassis and temporarily short-circuited a portion of the voltage divider which provides the biasing potential for the tube. Sure enough, it flashed okay. But it was hard to explain that the voltage-divider resistors had changed in value and needed replacement. "Why couldn't I just put in a new tube and try it without monkeying

(*Turn to page* 425)

THESE records from an anonymous serviceman's diary should be of decided interest to veteran servicemen, as well as to those whose experience in the service field is more limited. Written by a man who "knows his stuff," and shot with an occasional outcropping of humor, these items provide many hints not found in text books. More of these pages will appear from time to time.

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Old-timers and newcomers are making more money in Radio as a result of my training. If you are in Radio now, you know that *now* is the time to get extra technical training. If you are just starting in Radio, *now* is the time to get started on the right track. Learn Radio the right way—not "the hard way"; I make it easy for you.

SERVICE MEN NOTE!

I have a special advanced course for you. This is fully described in my big free book, "More Money in Radio." Get the facts about my training. Get my free book and free lesson. The coupon is good for both —mail it to me today.

"$100 A MONTH SPARE TIME"

"Last year I worked on a farm for $25 per month. Now I am making about $100 per month in spare time Radio work. My prospects are good, because a large battery and electric company has asked me to locate my shop at their place of business. Several other men without your training wanted to locate there, but the owner did not think they knew enough about Radio. Your training has given me a bright outlook for the future." —Merlyn Hansen, Atlantic, Iowa.

MAKE GOOD MONEY FOR YOURSELF SERVICING RADIO SETS

"FULL VALUE"

"I hardly feel that I have paid you for the 'full measure of value' received from your course. I have taken other Radio training which was good, but from the practical angle your course did me the most good. The schematic diagrams in the lessons and the data sheets were a great help. I am going to keep the course right on my work bench, so I can use it for a reference in solving service problems as they come up."—Fred P. Steinmetz, Chandler, Indiana.

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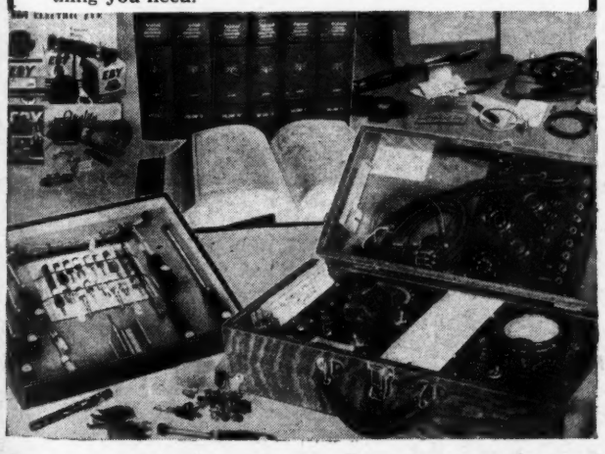

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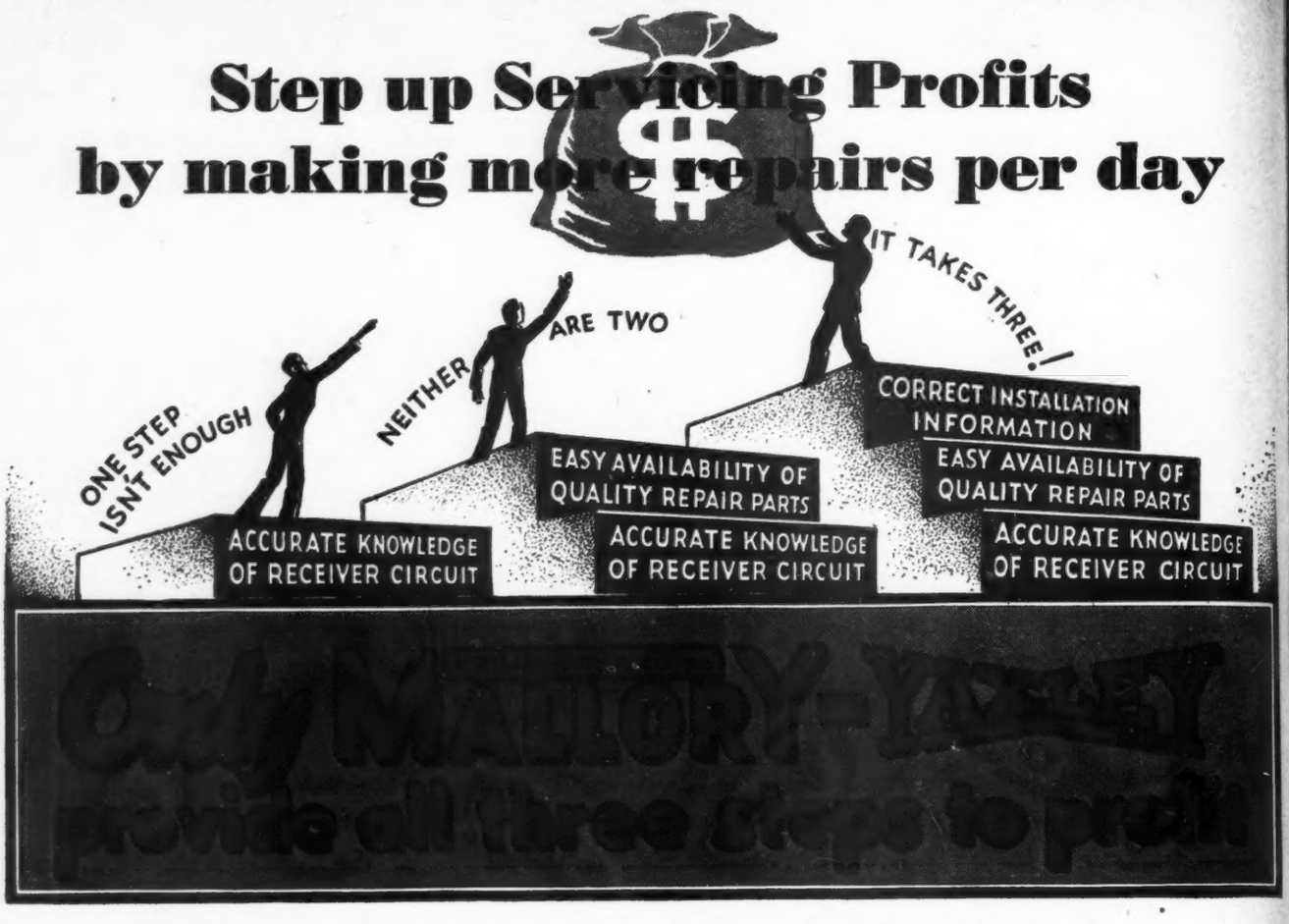

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(2) Easy availability of the required quality repair parts.

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Radio News

Volume XIX January, 1938 Number 7

Seventeen Years of BROADCASTING

(KDKA Installs Tallest Antenna)

THE world's highest antenna is now in service at Saxonburg, near Pittsburgh. It is of welded-steel construction, weighing 60 tons and 718 feet high. The whole weight of the tower is borne by a single porcelain insulator.

By **W. W. Rogers**

TWO Eskimos who, like almost everyone else, heard their first radio broadcasts from KDKA, those call letters still are synonymous with broadcasting itself. Now radio listeners in every clime are sharing the Eskimo's sentiments, joining with a world's pioneer commercial broadcasting station to celebrate its anniversary—the seventeenth.

Significantly enough, the high point of this seventeenth year of service was the dedication of another "first" in radio—the world's most modern and efficient antenna, a 718-foot steel "cloud-scraper" located at nearby Saxonburg, which will give primary service over an area ten times greater than that formerly provided with strong, clear signals. This sixty-ton spire, its top half often obscured by clouds, is now in operation.

The new antenna, like the other modern equipment in KDKA's present spacious quarters in the Grant Building, signalizes the amazing advances made by radio in seventeen brief years. It was November 2, 1920, that the original KDKA, housed—studio, sending equipment, technicians, talent all together—in one big room at the Westinghouse Headquarters Works in East Pittsburgh, flashed the news of Warren G. Harding's election to the few owners of amateur receiving sets then in existence. That daring venture inaugurated a daily program over KDKA which has continued without interruption for seventeen years. It also marked the beginning of commercial radio broadcasting.

First Station

The original KDKA stemmed from experiments by Dr. Conrad in his Wilkinsburg, Pa., garage going back to 1912. Before the World War Dr. Conrad had successfully "corresponded" with many radio amateurs in the United States. After developing a practical airplane radio transmitter for the government, Dr. Conrad returned to civilian life convinced that radio held even greater possibilities.

His first venture in broadcasting was with phonograph records borrowed for the purpose from a neighborhood dealer. Later he spiced his programs with vocal and instrumental talent. Soon a Pittsburgh department store began advertising receiving sets with which amateurs might pick up Dr. Conrad's popular broadcasts. To H. P. Davis, Westinghouse Vice-President and later Chairman of the Board of the National Broadcasting Company, the advertisement was an inspiration. Out of that inspiration came KDKA.

In the first few months of its operations program material still was drawn largely from Dr. Conrad's first source—phonograph records. Casting about for new and interesting variations, the Westinghouse Company turned to its own employes, who had a number of musical organizations, among them a very good band. When the band proved an enormous success with the fast-growing radio public, the KDKA Little Symphony Orchestra was formed.

NIGHT VIEW OF THE TOWER

The vertical line of lights above the station house glow in the darkness as searchlights illuminate the slender but tremendous tower.

Tent Used

These larger aggregations of talent necessitated seeking larger quarters, so one of the Company auditoriums was pressed into service. But auditoriums of even the most modern type in those days were not suited to radio broadcasting, and room resonance soon drove the musicians into the open air. A tent was set up on top of one of the buildings and served

THE COMPLETE STATION AS IT WAS IN THE YEAR 1920

Here you see all there was to the original KDKA. The transmitter is in the corner of the room, with the station engineer making adjustments. Two line operators, extreme left and right, are shown copying news reports of the Harding-Cox election returns. The announcer reads the returns into the box microphone.

admirably until a high wind blew it away in the fall of 1921.

Forced to move indoors again, the engineers tried pitching the tent in a room. It worked. The next step saw the tent removed and the walls of the room draped with burlap. A far cry from today's specially constructed non-resonant walls and ceilings, but the forerunner of the monk's cloth drapes still used in some studios.

Now on Super Power

Today KDKA operates on 50,000 watts. Seventeen years ago its power was only 100 watts, but even that caused its complications. Too powerful for the homemade receiving sets of the amateurs who previously had had the air to themselves, KDKA soon found itself confronted with a serious problem. But by the end of 1921, an unprecedented public interest that swamped an infant industry with demands for more of what KDKA had been giving it, convinced amateur senders they would have to adjust themselves to the young giant.

Early Innovations

Radio broadcasting became a conversational topic as universal as the weather. A scientific novelty had become a public service. Each new addition to the program repertory brought in a wider circle of avid listeners, for KDKA early in its history departed from the purely musical routine to introduce a broader range of material.

One of the early innovations was the broadcasting of a full regular church service. That was not as easy as it sounds today, for most people, and probably most ministers, still regarded radio as a medium of unproven value. One, however, the Rev. Dr. E. J. van Etten, Rector of Calvary Episcopal Church, Pittsburgh, shared the enthusiasm of Westinghouse engineers for the new means of communication. On January 2, 1921, Dr. van Etten's voice went over the air —the first to broadcast a divine service.

Features Broadcast

On January 15, 1921, KDKA carried Herbert Hoover's first broadcast, an appeal for funds for European relief at the Duquesne Club, Pittsburgh. On February 15 of that year KDKA transmitted an address by Miss Alice M. Robertson of Oklahoma, the nation's first Congresswoman.

One of the earliest and most popular innovations was the retransmission of Arlington Time Signals with which KDKA for years "signed off" its nightly programs. Sports events were broadcast by KDKA—a boxing bout between Johnny Ray and Johnny Dundee in Motor Square Garden, Pittsburgh, on April 11, 1921, being the first. On May 9, 1921, KDKA broadcast from the stage of the Davis Theater in Pittsburgh a complete theatrical program. On August 5, the station transmitted a play-by-play baseball account from Forbes Field, Pittsburgh. That same month it broadcast running comment on the Davis Cup matches at the Allegheny Country Club, Sewickley, Pa. Both radio and "Big Bill" Tilden were just beginning in those days; the fact that both are still going strong is graphically illustrative of the industry's youth.

In the constant effort to develop a diversified program, KDKA was the first radio station to attempt a regular farm service, which included not only livestock, hay and grain reports, but also weather forecasts. On May 19, 1921, KDKA was authorized to broadcast government market reports.

Instruments Introduced

In the beginning all sorts of persons were pressed into service as announcers, willingness being the prime requisite. Soon it was discovered that training in diction and pronunciation was necessary, since for every mispronounced word there were many letters from listeners. An Announcer's School began to take out kinks.

One of the early fundamental problems that had to be surmounted had to do with the fact that characteristics of the microphone were quite different from those of the human ear. Studio groupings and the laws that govern them were unknown in those pioneering days, but A. G. Popcke, a Westinghouse engineer, soon worked out a chart showing the proper location of soloists and piano, and of instruments in various combinations from trios to symphony orchestras.

Modulation Controlled

To provide a means for controlling the varying musical tones, a modulation meter calibrated from 1-100 was devised. This instrument has since become standard equipment in

"PLOUGHING UNDER" COPPER WIRE AT KDKA

For the new ground system at Saxonburg 50 miles of wire was buried in 700-foot lengths radiating from the central tower. A tractor and a specially fitted plow dug a shallow trench one foot deep into which the wire was laid.

every transmitter. It is used to study the effect of different kinds of music or frequencies upon the current in the modulating tubes—an important factor that determines the quality of broadcasting, since over-modulation causes distortion, and under-modulation gives too weak a signal, difficult to reproduce clearly on the receiving sets.

Short Wave Pioneering

Meanwhile, KDKA was reaching out and pioneering in a branch of development of the radio art which now bids fair to be the most important in the entire science of communication—short wave transmission.

Even prior to the establishment of KDKA as a station, Dr. Conrad had become convinced of the value of short waves, and by 1922, he had convinced associates that possibilities were being overlooked in the then unused and rather despised short-wave bands. An experimental station known as KDPM was installed in Cleveland, and serious work was undertaken between it and KDKA. In the fall of 1923, the company located a rebroadcasting station, KFKX, at Hastings, Nebraska, which nightly received and re-broadcast KDKA programs.

Heard in Australia

On New Year's Eve, 1923, through previous arrangements, KDKA transmitted a short-wave program to Great Britain. On December 12, 1924, KDKA's short-wave program was received and re-transmitted in Johannesburg, South Africa, by a newspaper there, the Johannesburg Star. A few weeks later KDKA transmitted a program to Australia.

In 1926, KDKA and sister Westinghouse stations, among them WJZ, then located at the Westinghouse Works in Newark, N. J., were the first to become member stations of the great National Broadcasting Company chain which was then forming.

So it is that, after eleven years of association in the continued improvement of radio facilities, Westinghouse and NBC join in signalizing past and present achievements.

Phenomenal Success

In seventeen years broadcasting stations have multiplied into many thousands. A modest experiment in one room has become a billion-dollar industry. A world of entertainment and information undreamed of a few years ago is at the constant beck and call of everyone, at no charge other than the initial cost of a radio receiver.

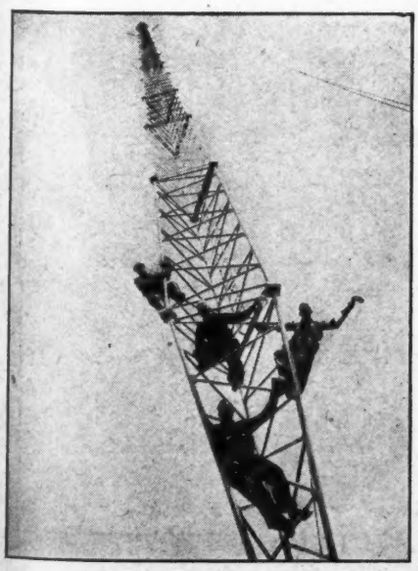
Yet in spite of the rapid strides made in the industry, in spite of the growing competition everywhere, the new giant antenna at Saxonburg vindicates an early antenna design of Dr. Frank Conrad, just as the whole institution of radio and its phenomenal success justify this great engineer's faith in it at a time when few believed that the transmission of sound without wires would ever become perhaps the greatest single force in history.

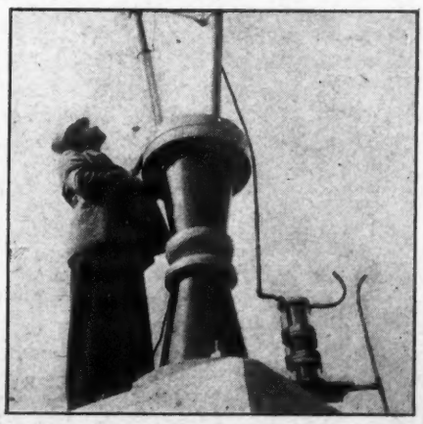
1937—WHAT A DIFFERENCE IN THE MODERN KDKA!

The modern transmitter room as viewed through the windows of the control room, which is a distance of 20 miles from the original studios in Pittsburgh.

A TICKLISH CONSTRUCTION JOB

These steel riggers look happy! And they ought to be, for they are on their way down after finishing the construction of the world's tallest welded-steel tower. The man looking up (in the smaller photo) may well wonder how these insulators and such a slender base can support the structure.





Ten-Fold Improvement

KDKA's new antenna system is giving primary broadcasting service over an area ten times greater than that previously provided with strong, clear radio signals. Principal elements of the improved radiating facilities are the main antenna, a steel spire towering 718 feet high, and a circle of eight 90-foot antennas designed to suppress interfering waves normally emitted in radio transmitting. Vertical antennas of the type now installed at KDKA radiate both ground and sky waves. When these two waves meet in areas of varying distance from that station they interfere with each other to cause fading or mushy program reception. The ring of shorter towers also radiate skywaves but in opposite directions to nullify the effect of the skywave emitted from the main antenna. The fading zone is thus extended to great distances from the station and broadcast service vastly improved.

Welded Steel Tower

So high that its top half is often obscured by clouds, KDKA's spire is composed of thirty-two three-cornered welded steel sections. Only five feet wide, these sections are bolted together. Two sets of long guy wires hold the antenna upright. The 60 ton structure rests in the ball-and-socket joint of a single large porcelain insulator, (*Turn to page* 444)

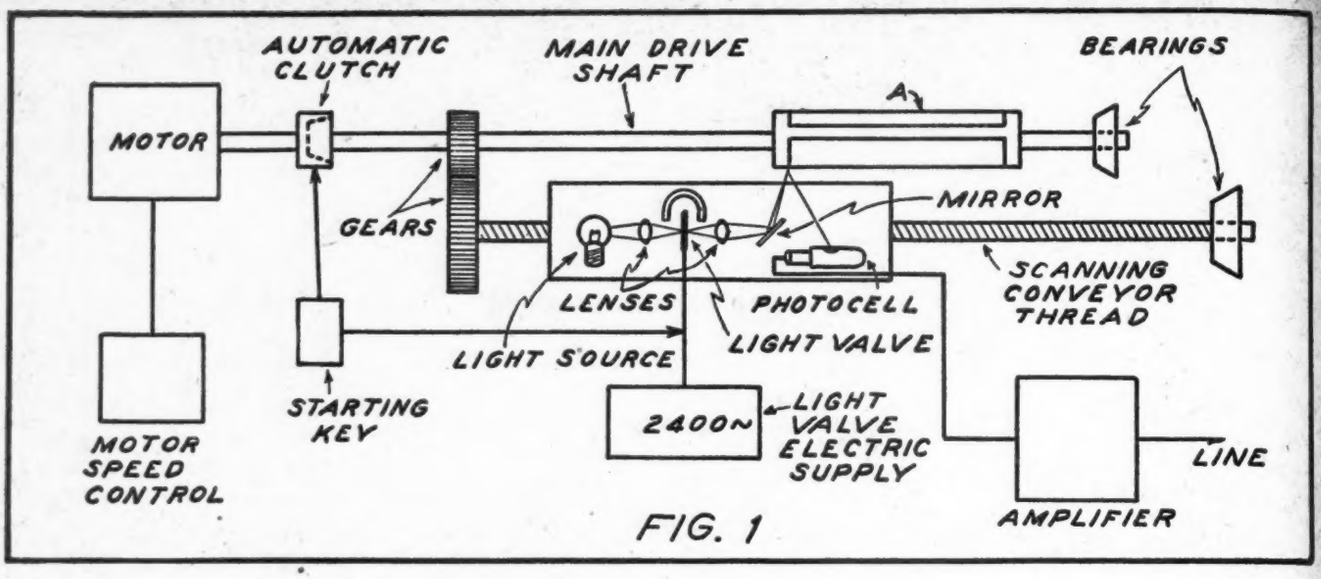


FIG. 1

Practical Lessons in TELEVISION

(Lesson One: Sending a Picture)

PERHAPS the most basic of all the ideas utilized in Television to the present day was brought forth even before the twentieth century by P. Nipkow, who was a Polish scientist. He had no thought of television in mind at the time, as this was in 1884, before the practical telephone or the practical use of the electric light bulb. Scarcely three years before this, Thomas A. Edison exhibited the first incandescent lamp in Paris, using the carbon of a small splint of bamboo as the filament. It hardly seems possible that television got its start almost with the incandescent lamp, but it had to await development of subsequent arts before these items could be borrowed and adapted for its use. To grasp the full significance of television in its present form, we must turn from electricity, to physics, to optics, to electronics and to chemistry as readily as a linguist may turn to one of many languages. Rather than a handicap to this study, we will find that this is really an advantage because of the similarity of each branch of science to others and the theories applying to one branch fitting another just as perfectly.

LIKE all developments of present-day scientific marvels, television to the uninitiated seems to be too complicated for even a mediocre understanding. But such is not really the case if the layman is first presented with the fundamental ideas involved. Television has borrowed these ideas from so many different arts and its development has taken such an indirect course that its exact beginning may seem somewhat obscure. We can, however, trace its development from the various sources and present these ideas so that any interested person can grasp the principles without too much difficulty. This series begins with a description of picture transmission and elementary "scanning." If you are a radioman, it is important that during the next year you learn what television is and how it is accomplished. Start today and don't miss a single lesson.

By F. L. Sprayberry

Picture Transmission

Were we studying moving pictures as employed in the theatre, we would naturally start with the projection of our picture and then simply show how the means were applied to project a number of slightly different pictures in rapid succession *to give the illusion of motion.* So it is with television, we start with the transmission of one picture and then show what means are required to perform the same basic operation many times per second *to also give the illusion of motion in the succession of slightly differing pictures.*

Only a small percentage of people realize today that a great number of pictures are sent by wire for newspapers and that the art of Wire Photography, also called Telephotography, has advanced to a highly refined stage. A picture may be taken with an ordinary camera in Seattle, Washington, for example, from which a negative may be made and sent to the location of the picture transmitting equipment. To the telephone

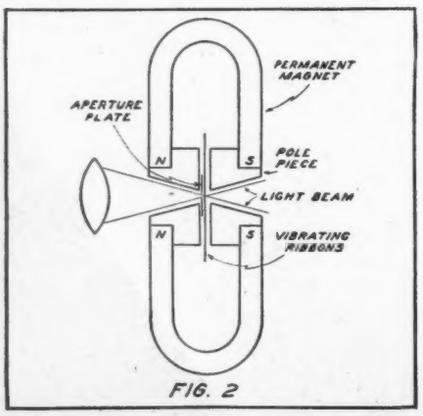


FIG. 2

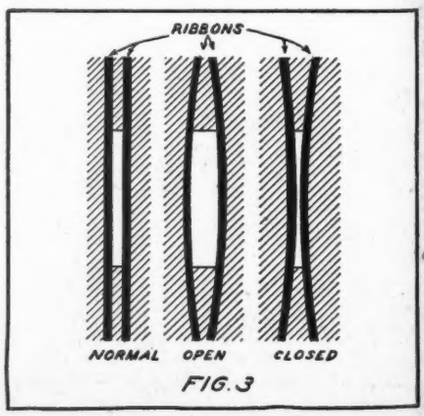


FIG. 3

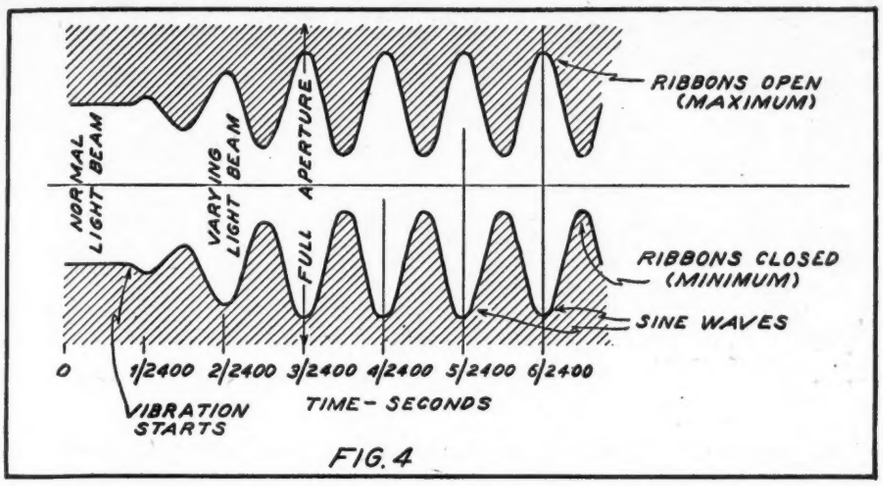


FIG. 4

HOW A LIGHT GATE WORKS

Figure 4. Showing how the ribbons, upon opening and closing, modulate the light intensity.

lines may be attached any number of picture receiving units and within a short time the picture may be showing on the news-stand in twenty-five or more cities all over the United States. This may be extended to foreign countries as well, through the use of a radio in place of a wire line.

Let us look into the details of this process as it will be a big step in the understanding of modern television. In Figure 1 is shown a diagram of a picture transmitting equipment. Any photograph up to 11 by 17 inches is placed on the cylinder "A" with its back toward the cylinder, usually with its longer dimension along the length of the cylinder. Means are provided for clamping the photograph onto the surface of the cylinder. The latter is approximately 3¾ inches in diameter or 12 inches in circumference, so that only a 1-inch space is left along the cylinder if an 11-inch picture is used. The cylinder is rotated by means of a speed-controlled d.c. motor through an automatic clutch on its shaft at exactly 100 revolutions-per-minute. A reduction gear mechanism on the cylinder shaft and an auxiliary shaft serves to drive a long threaded shaft beside the cylinder and parallel to it. On this shaft is mounted an assembly which it moves at the rate of 1 inch per minute in exactly the same manner that a cutting tool is carried along the "work" on a metal lathe. Of course, the gear ratio and the pitch of the thread on the second mentioned shaft is made to provide this speed of rotation and of movement of the assembly. In this assembly is housed the means for resolving the picture into a signal ("dissecting" or "scanning") for transmission. The light from an ordinary electric lamp, actually an automobile headlight lamp, is focused on a fixed mirror through a mechanical light valve. The mirror reflects the light beam onto a spot on the picture, one hundredth of an inch square which in turn reflects the remaining light back into the assembly and onto the cathode of a photo-electric cell.

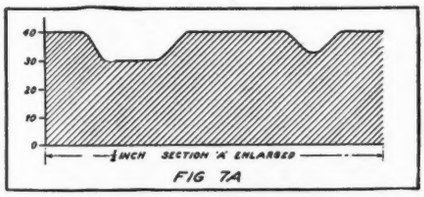


FIG 7A

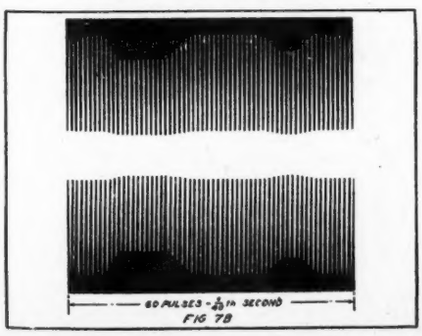


FIG 7B

How It Works

Suppose we now turn to a study of how these pieces of apparatus are capable of producing a signal by which a picture may be rebuilt. The light is of constant intensity and by means of the lens between it and the light valve, is focused almost to a point at the light valve. The light valve consists of two ribbons connected at one end forming a hairpin loop suspended in a powerful magnetic field. As seen in Figure 2, this field is constructed somewhat like a dynamic speaker field except that the air gap between the two magnet poles is flat and rectangular instead of cylindrical and permanent magnets are used. A hole in the center of the magnet is provided and it is fitted with a metal plate with a slit about ¼ inch long and .01 inch wide. In passing through this slit or aperture the light next comes to the two ribbons as in Figure 2. An alternating current of 2400 cycles is impressed on the two open ends of the two ribbons and they vibrate at 2400 cycles because of the action of the main permanent magnetic field on the 2400 cycle field. The action of the two fields, one due to the permanent magnets and one due to the 2400 cycle current moves the ribbons "laterally" across the permanent magnetic field. When in their normal positions they partially conceal the total light "gate" or aperture as in Figure 3. When the ribbons separate, more light may pass through the gate, but when together very little light may pass. As current is flowing down one ribbon, it flows up the other one, thus they move in opposite directions.

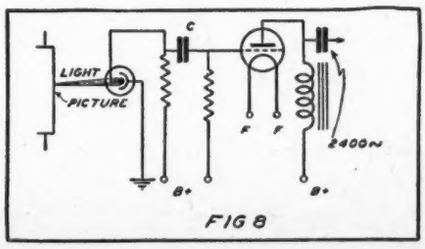


FIG 8

What the Graph Shows

At high speed these ribbons move in a wave-like manner, like a violin string or a pendulum. Therefore, if we make a graph of a few complete cycles of motion showing the relative size of the cross section of light passing through the gate as in Figure 4, we will have a good idea of the light fluctuation reaching the mirror. It will increase and decrease in a sine-wave manner as shown.

Beam Modulating

From the mirror this light is projected onto the rotating cylinder carrying the picture to be transmitted. The light reaches the picture when focused to a point .01 inch square and is reflected from the picture back into the moving assembly and into a photo-cell (photo-cell to be explained later). The picture will reflect various amounts of light depending on whether it is black or white at that point or in proportion to any graduation between black and white as it passes under the light beam. Practically no light will be reflected from a black area while a large percentage of light will be reflected from a white area. In other words, shading in photographs will modulate the clear beam of light from the light source. In addition to this the amount of light will be proportional to the tone or grade between

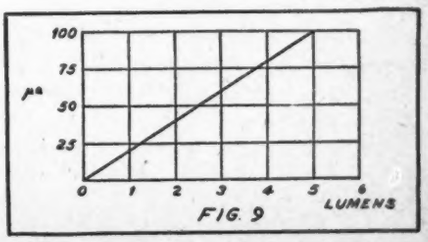


FIG. 9

black and white of the picture. As the cylinder rotates the light traces a "helical" path on the picture as the unit carrying the light source and apparatus just described moves at the rate of .01 inch per revolution of the cylinder. The area traced by the light is much like the thread groove on the end of a pipe, one groove being directly adjacent to the next one.

How Scanning Works

A study of the photograph in Figure 5 will show how this works. Note particularly the line through the photograph. This represents one tracing across the photograph. This one tracing or single beam of light as shown in Figure 5 (this beam of light would be reflected from the drum A in Figure 1) strikes the cathode of the photo-cell shown in Figure 1. The photo-cell changes the shadings of light intensities into electrical pulses which correspond exactly to the light intensities which strike the photo-cell. Thus intensities of light are changed into electrical pulses—and remember these represent reflections of one narrow strip of light from the photograph of Figure 5, which we are imagining is placed on drum A of Figure 1.

Light Fluctuations

You are, no doubt, interested in the nature of the electrical pulses which represent the one narrow strip across the photograph of Figure 5. A graph of these pulses is shown in Figure 6.

Referring now to the photograph of Figure 5, from left to right, we first come to the wall in the picture which is quite light and may reflect about 80% of the light back onto the photo-cell. The modulated light fluctuates a trifle responding to the "grain" of the wall as seen. Then the picture turns with the side of the radio cabinet under the light. This is much darker and suddenly the percentage of reflected light reduces to below 40%. See the electrical equivalent in Figure 6.

Picture Analyzing

Due to the "beading" and other decorative designs on the radio cabinet, this light as reflected varies some 10% in the region entering the cabinet side from the wall to the left and at other places. The "grain" of the cabinet top forms slight variations in the reflected light and so on.

In further pursuit of what happens in this instrument, let us take a small section (A of Figure 6) representing a length along the "scanning" or dissecting direction and give it further study. Let us say that the distance "A" is ½ inch long, and that the picture is moving under the light at the rate of 20 inches per second. To move distance "A" (½ inch) then only requires 1/40th of a second and in this time the modulated light sends 60 "pulses" of light to the picture. If it produces 2400 pulses (cycles) in 1 second, in 1/40th of a second it must send 2400/40 or 60 pulses of light to the picture to be reflected. These 60 pulses of reflected light on an enlarged scale would look graphically like Figure 7B. In Figure 7A we have duplicated section "A" on a much enlarged scale so that we can examine it more closely.

Figure 7B represents the actual amount of light falling on the photo-cell. We now must consider what this photo-cell is and what use it makes of those light pulses. The photo-cell used here is a type of vacuum tube having an anode element in the form of a circular ring and a cathode in the form of a circular disc. Of course, the construction of various types of photo-cells differ widely and some use a rod anode instead of the ring and a cylindrical cathode instead of a circular disc. Some even use a coating of metal condensed on the inner surface of the glass envelope as a cathode.

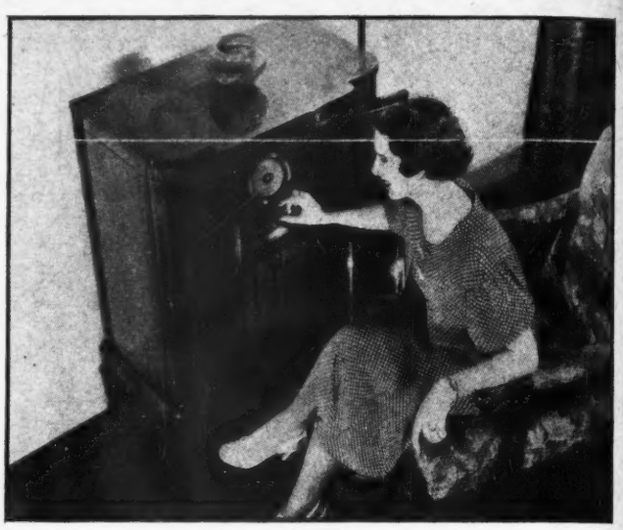


FIGURE 5

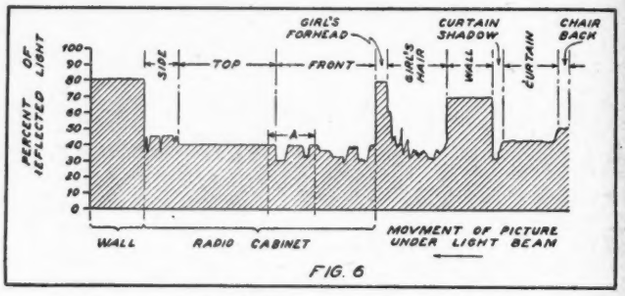


FIG. 6

WHAT A "SCANNING" LINE REALLY MEANS

The photograph above, Figure 5, shows a scene being televised, the white line across the picture representing a scanning line. The diagram in Figure 6 shows how this line of light reflected from the scene will produce a varying electric current in accordance with light and dark portions of the scene.

How the Photo Cell Works

A d. c. voltage is impressed between the anode and cathode with, of course, cathode negative and anode positive and the reflected light from the picture is impressed on the cathode of the photo-cell. The cathode has been chemically prepared in such a way that it will discharge electrons when exposed to light and there will, of course, result a current of electrons to the anode.

Now the number of electrons liberated from the cathode depends very closely on the amount of light reaching it and since all liberated electrons are attracted by the anode having but one positive voltage value, the electron current depends on the light striking the cathode. Moreover the current is proportional to the amount of light reflected into the photo-cell.

The current flowing through the photo-cell circuit would, therefore, have 2400 pulses per second (if we employ the system of Figure 1) and the amplitude of the successive pulses would be modulated by the tone value of the original picture.

The photo-cell circuit is wired exactly as the plate circuit of an amplifying tube would be wired as in Figure 8. The effect of the light on the cathode is almost precisely like that of a control grid in a triode although the anode current here follows the light changes more accurately proportional than the plate current changes in a triode follow the grid voltage changes. What is equivalent to the Eg-Ip curve in a triode, is the light—anode current. For a given anode voltage, 60 to 250 volts, depending on the cell, Figure 9 shows the perfectly linear relationship between the light intensity and the anode current.

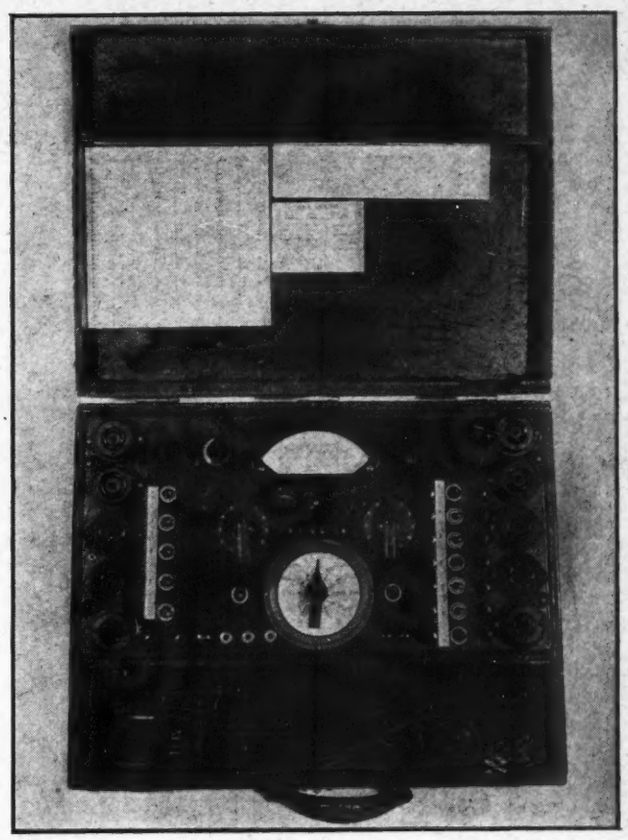
The Light Unit

To get a good idea of the size or magnitude of a "lumen" of light, one standard candle power requires very roughly 1 watt of power. Of course, if the power is used for lighting a filament type lamp, a good portion is converted into (*Turn to page* 423)

The Single UNIT *Servicer*

Here the author describes a readily portable home-made service instrument which provides every kind of check or measurement encountered in normal service work

***By* Allen J. Loeb**



A PRACTICAL SERVICE TOOL

Compact and really portable, this unit combines the functions of an analyzer, tube checker, multimeter and inductance capacity checker.

MANY servicemen find themselves unable, because of limited incomes, to purchase the elaborate testing equipment featured in the new catalogs. Economy dictates the use of one set of equipment for both portable and shop use, and convenience suggests one instrument combining as many functions as possible. The analyzer described in this article can be built for about thirty dollars (current mail-order prices). It has been in daily use for the past six months, and with the exception of a small signal generator has been the only instrument in a small service shop. It is only necessary to add that all functions required in the servicing field have been performed with ease.

THE central feature of the analyzer is a Beede fan-type meter which is used in conjunction with a small copper-oxide rectifier for all readings. There are five voltage and three current ranges for either a.c. or d.c., high and low resistance ranges (with provision for testing resistances above 200,000 ohms using an external voltage source), and a capacity-impedance testing range which will be described in some detail below. This meter is also used as the indicating device in a sensitive tube short-checker which will reveal high or low resistance short circuits in any glass or metal tube.

Fuse Protects Meter

Provision has been made for output readings using any a.c. range by the inclusion of a blocking condenser (C1) and an extra banana jack on the panel. Ranges are selected by means of an eleven position, double pole switch (Sw1) located directly below the meter in the center of the panel, and a meter reversing switch has been included. A single 1/100 ampere fuse provides adequate protection at all times.

Perhaps the most distinctive element in the circuit is the numbering system used in set analysis. This is based on the system worked out by the R.M.A. for the octal base tubes and is readily adaptable to future developments. In it the number 1 always represents the ground or shield connection. In tubes that are not shielded, numbering starts with the first heater (or filament) connection which is number 2 and progresses clockwise around the socket when viewed from the underside. Thus the plate connection is number 3 in almost every case and the various grids in multi-element tubes are numbers 4, 5 and 6 depending on the number of prongs. The remaining heater connection, then, is number 7 and the cathode, number 8. Cap connections are designated as number 9 on any type tube. A glance at figure 2 will make this system quite clear to the reader.

Simple to Operate

Two single-deck eleven-point switches (Sw4 and Sw5) are used to connect the meter for voltage readings between any two elements. These switches are provided with dial plates marked 1 to 11, the last two positions being left blank and held in reserve for later tube developments. In the circuit of each element there is a single pole — single throw toggle switch (Sw6 through Sw12) which is normally closed and opened only when taking current readings. Thus, to determine the plate current of a tube in the analyzer socket it is only necessary to set both voltage switches (Sw4 and Sw5) to the number 3, or plate, position and open the toggle switch in that circuit.

Provision for Noise Tests

Connected on either side of each toggle switch there is a banana jack, the pair of jacks providing easy access to any circuit whenever the switch is open. This makes it possible to introduce earphones or other external apparatus in series with any tube element. It may also be used to connect the meter for output measurements using the analyzer plug rather than external leads. This double row of jacks and toggle switches is located on the right side of the panel and the switches numbered in accordance with the system described above.

On the other side of the panel there are five double-pole double-throw switches (Sw13 through Sw17) located directly adjacent to the 4, 5, 6, 7 and 8 prong analyzer sockets and used for tube testing by the grid-swing method. These introduce six volts provided by a flashlight battery into any one of the five possible control-grid circuits and are likewise numbered in the system described. A chart (Figure 3) in the analyzer cover indicates the number of the plate and

control-grid connections for each type tube.

The short-checker used in this analyzer utilizes a very interesting principle. It is entirely independent of the rest of the unit except that it uses the 0-200,000 ohm scale of the meter as an indicating device. In order, therefore, to connect it for use, it is merely necessary to set the range switch to the high-ohm scale.

Testing for "Shorts"

This portion of the tester includes a row of five tube sockets mounted along the extreme right edge of the panel. Corresponding connections of these sockets are tied together and are separated from one another by 6 one-watt carbon resistors (R1 through R6) so that when a good tube is inserted in one of the sockets, its filament completes the circuit and connects a total resistance of 150,000 ohms across the meter. This, obviously, causes a very slight but noticeable deflection on the 0-200,000 ohm scale. Should there be an internal short-circuit in the tube, however, one or more of the carbon resistors will be shorted out of the circuit reducing the total resistance and increasing the deflection accordingly. Because of the relatively low resistance of a tube filament the meter reading for a good tube is always the same (around 150,000 ohms) and any reading that differs from this in the slightest degree indicates a short in the tube. Should the filament be open, of course, there will be no reading. In cases of intermittent short circuits it is sometimes necessary to pre-heat the tube before testing. This simple method is applied to practically all tubes in general use. The few types which have filament terminals at other positions may be tested by the ohmmeter outside the socket.

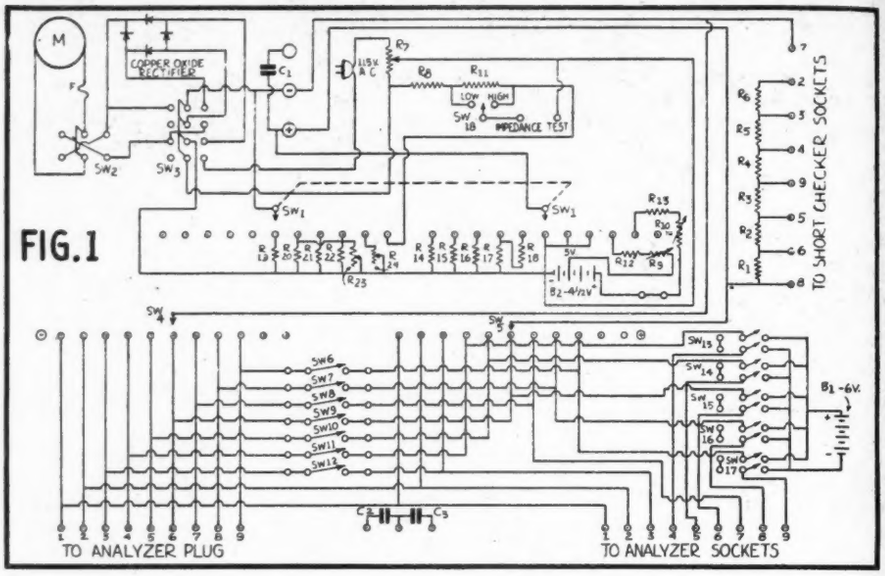


FIG. 1

The capacity-impedance testing section of the instrument is placed in operation by connecting the external plug to a source of 110 volts a.c., throwing the a.c.-d.c. switch (Sw3) to the a.c. position (it will be noticed that this switch which is of the four-pole double-throw type uses the fourth pole to complete the connection from the line plug when the switch is in the a.c. position thereby safeguarding the rectifier), and setting the range switch to the "cap-imp" position.

Terminals

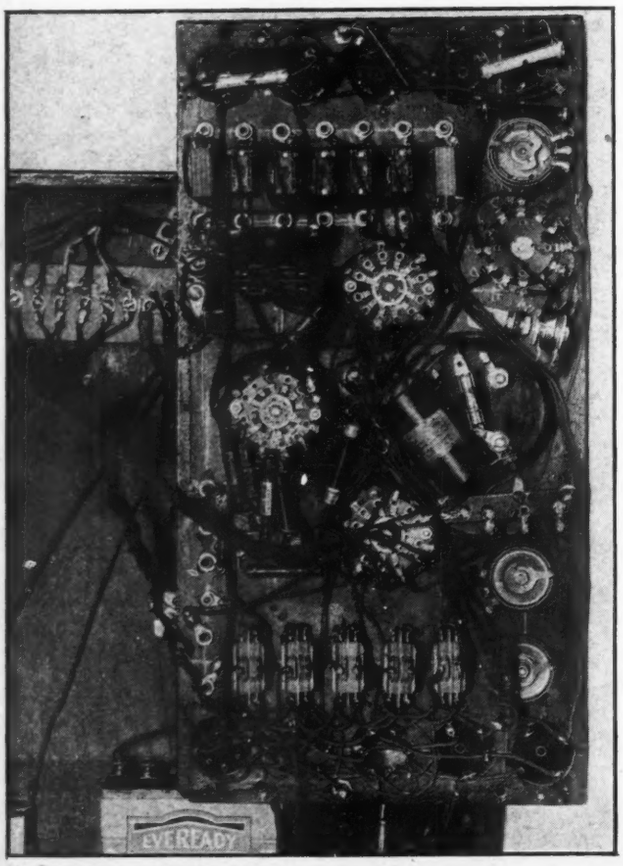
Following the circuit, it will be seen that the tester utilizes a 5000 ohm wire-wound variable resistor (R7) as a zero adjuster in order to compensate for varying line voltages. A single-pole double-throw switch (Sw18) is used to change the range for high or low impedances and a separate pair of jacks (green) is provided for the test leads. Leads for all other meter ranges terminate in a single pair of jacks located directly between the meter and the range switch in the center of the panel.

Testing Impedances

For high impedances such as those of condensers from .005 to 4 mfds. the impedance is placed in series with a 30,000 ohm resistor (R8) and the line voltage. The meter then acts as a high-resistance a.c. voltmeter and measures the voltage across the impedance under test. When the switch is in the "low impedance" position, the part being tested is placed across the line in series with a total resistance of 100,000 ohms. Then the meter acts as a low-resistance voltmeter. This range is useful for determining the impedances of chokes, transformer windings, etc. Of course, the meter can be calibrated in terms of impedances and capacities and charts or graphs made up.

Substitution Test

There is one other feature which, despite its great simplicity, is worthy of some comment. This is the condenser selector which consists of a one and an eight mfd. paper condenser and three yellow tip jacks on the lower left edge of the panel. Every service-man has wasted valuable time and even more valuable patience trying to find the place where slight additional by-passing was needed to eliminate a.c. hum. By having two standard size condensers connected to a trio of banana jacks on his analyzer panel, the serviceman can use his test leads to make substitutions and determine the source of



BEHIND THE SCENES

Here the layout and wiring are shown clearly, indicating, in conjunction with Figure 4, the exact placement of all switches and other components.

hum rapidly and with ease.

The layouts of parts on the 8 by 16 inch panel on which the analyzer is built has been fairly well covered in the preceding paragraphs. There are a few additional points, however.

The two variable resistors (R9 and R10) which are used as zero adjusters for the resistance reading scales are located on the upper edge of the panel between the tube sockets and the meter. R23 and R24 are mounted beneath the panel and are adjusted until the resistance scale reads exactly the value of a known resistance. The a.c.-d.c. switch and the impedance zero adjuster occupy the same positions on the opposite side. The meter-reversing switch (Sw2) and the impedance range switch are located respectively on the right and left sides of the range switch. There are three binding posts on the lower edge of the panel, two of which (normally connected by a jumper) are for an external voltage for resistance measurements above 200,000 ohms and the third, for a chassis lead to sets under test where this is desired.

It will be seen, therefore, that the layout of the panel is almost perfectly symmetrical. For the range switch, I used a large bar knob over a disk of white cardboard which is marked off to the various meter scales and held down by a 3-inch round escutcheon of the "airplane" dial type.

The Cabinet

The analyzer cabinet and panel are made of ⅜-inch plywood, assembled with 1-inch brads and glue. The box measures 12¼ by 16 by 2⅝ inches. The cover is 1¼ inches deep. Specifications for the panel are given in Figure 4.

List of Parts

C1, Paper condenser, 5 mfd., 600 v.
C2, Paper condenser, 1 mfd., 600 v.
C3, Electrolytic condenser, 8 mfd., 600 v.
R1, R3, R4, R6, Carbon resistor, 20,000 ohms, 1 watt
R2, R8, Carbon resistor, 30,000 ohms, 1 watt
R5, Carbon resistor, 40,000 ohms, 1 watt
R7, Potentiometer, 5,000 ohms
R9, R22, Rheostat, 25 ohms
R10, Rheostat, 750 ahms
R11, Carbon resistor, 70,000 ohms
R12, Wire-wound resistor, 15 ohms
R13, Wire-wound resistor, 2,500 ohms
R14, Carbon resistor, 5,000 ohms
R15, Wire-round resistor, 10,000 ohms
R16, Carbon resistor, 50,000 ohms
R17, Carbon resistor, 250,000 ohms
R18, Carbon resistor, 500,000 ohms
R19, Radio City, 5 mil. meter shunt
R20, Radio City, 50 mil. meter shunt
R21, Radio City, 500 mil. meter shunt
R23, Rheostat, 30 ohms
R24, Rheostat, 400 ohms
Sw1, 2-deck, 11-point switch
Sw2, Sw13, Sw14, Sw15, Sw16, Sw17, Double-pole, double-throw toggle switch
Sw3, Eby 4-pole double-throw switch
Sw4, Sw5, 1 deck, 11 point switch
Sw6, Sw7, Sw8, Sw9, Sw10, Sw11, Sw12, single-pole, single-throw toggle switches
Sw18, Single-pole, double-throw toggle switch
B1, B2, 6-volt dry cell battery
2 8-prong tube sockets
2 7-prong tube sockets
2 6-prong tube sockets
2 5-prong tube sockets
2 4-prong tube sockets
1 8-prong analyzer plug
1 9-wire cable
1 set of plug adapters
2 banana jacks (green)
3 banana jacks (yellow)
8 banana jacks (red)
9 banana jacks (black)
2 small tip jacks
3 binding posts
1 2-wire plug connector
knobs, dial plates, etc.
Beede O-1 mil. fan-type meter
Copper-oxide rectifier
1/100-ampere fuse and holder

The parts listed above represent the actual components employed in the instrument described, with the exception of C3, which is a paper-type condenser instead of the electrolytic specified. Some builders may have difficulty in obtaining 600 volt paper condensers of sufficiently small dimensions to fit within the cabinet. The required 8 mfd. may be made up, of course, by using several 1 or 2 mfd. paper condensers in parallel. If the electrolytic type is employed, care should be taken to observe the proper polarity of its terminals when connecting it across the circuit under test.

Those who have on hand other type meters which they wish to adapt to this circuit may do so providing the values of the resistances in the ohmmeter circuit are adjusted to match the scale employed on the meter selected. This may be done by adjusting the series resistances for each range until the meter gives full scale deflection with the test leads shorted and half-scale reading when the leads are connected across a resistance of a value corresponding to the half-scale ohmmeter calibration point.

For other type meters, of course, the shunts specified will not be suitable unless the internal resistance of the meter is the same as that of the one specified in the article. The same multipliers may be employed, however. For greater precision, accurate wire-wound multipliers are preferable but the cost of the instrument will then be appreciably increased.

FIG. 2 NUMBERING SYSTEM

FIG. 3 TUBE TESTING CHART

TUBE	PLATE	GRID	TUBE	PLATE	GRID	TUBE	PLATE	GRID
00A	3	4	6K7	3	8	41	3	5
01A	3	4	6L6	3	5	42	3	8
1A4	3	9	6L7	3	3,5	43	3	8
1A6	3	9	6N7	3,6	4,5	45	3	4
1B4	3	9	6Q7	3,4,5	9	46	3	4
1B5	3,4,5	8	6R7	3,4,5	9	47	3	4
1C6	3	9,5	6X5	3,5		48	3	5
1F4	3	4	10	3	4	49	3	4
1F6	3,5,8	9	11	3	7	50	3	4
1V	3		12	3	4	53	3,8	4,6
2A3	3	4	12A	3	4	55	3,4,5	9
2A5	3	5	12Z3	3		56	3	4
2A6	3,4,5	9	15	3	9	57	3	9
2A7	3	9,6	19	3,8	4,5	58	3	9
2B7	3,5,6	9	20	3	4	59	3	5
5W4	4,6		22	3	9	71A	3	4
5Z3	3,4		24A	3	9	75	3,4,5	9
5Z4	4,6		25A6	3	5	76	3	4
6A4	3	4	25L6	3	5	77	3	9
6A6	3	4,6	25Z5	3,8		78	3	3
6A7	3	9,6	25Z6	3,5		79	3,8	4,9
6A8	3	9,5	26	3	4	80	3,4	
6B7	3,5,6	9	27	3	4	81	3	
6B8	3,4,5	9	30	3	4	82	3,4	
6C5	3	8	31	3	4	83	3,4	
6C6	3	9	32	3	9	83V	3,4	
6D6	3	8	33	3	4	84	3,4	
6E5	3	4	34	3	9	85	3,4,5	9
6F5	4	9	35	3	9	89	3	9
6F6	3	5	36	3	9	Y99	4	2
6F7	3,4	9,5	37	3	4	X99	3	4
6G5	3	4	38	3	9			
6H6	3,5		44	3	9			
6J7	3	9	40	3	4			

R S A Growing Fast

Chicago, Ill.—The recent announcement of the formation of the Radio Servicemen of America brought a large number of applications for membership from existing local groups of servicemen, including such prominent organizations as those in Cleveland, Chicago, Binghamton, Denver, and Duluth.

Servicemen interested in joining this national organization are invited to write Radio Servicemen of America, Room 1533, 304 S. Dearborn Street, Chicago, Illinois, for an application blank and information on how to become a member. Groups are invited to inquire concerning a charter from this national organization of, by, and for radio servicemen.

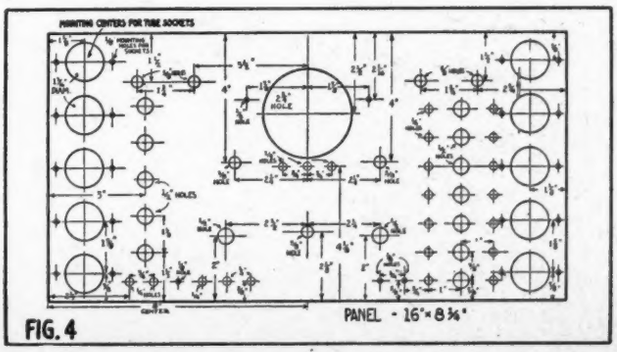


FIG. 4

PANEL DRILLING PLAN

Since a plywood panel is employed for this instrument, the large holes shown are easy to drill. Adequate spacing makes for simplicity in assembly and wiring.

Service-

This Month:

A Xmas Set-up . . . Service Shops . . . The Floor Plan . . . Common Ailment . . . Servicing with the Oscilloscope . . . SERVICING: Browning, Belmont, Wings, Bosch, Silvertone, Majestic and Arvin

Figure 2. An English shop devoted exclusively to radio service—largely for the trade.

THE RADIO STORE AT XMAS

THE fact that more buying is done during the week immediately preceding Xmas than during any other six-day period in the year does not mean that it is any easier to secure one's own share of business. As a matter of fact, competition is particularly keen over the yuletide, and it is only by good salesmanship and all the trimmings that full advantage can be taken of the festive Buying Spirit. The word "trimmings" can be taken literally, as we refer largely to store and window displays.

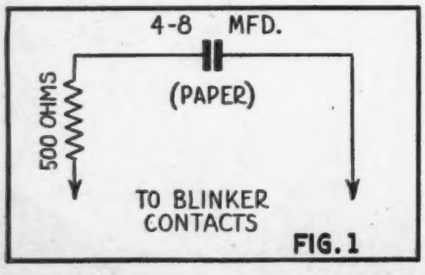
YOUR distributor and set and tube manufacturers should be given every opportunity to cooperate with you in preparing attractive displays. Many of them have prepared special holiday material and have sent you literature describing the same. Make a generous selection of cartons, backgrounds, manikins, streamers, etc., etc. that will fit in with your general scheme of things. Such display material—

Plus a Bit of Originality

will do much to attract customers into your store and shop. Originality and the personal touch are highly desirable to individualize your establishment among others that may be using similar commercial material. You needn't be an interior decorator to prepare an attractive window. A bit of common sense and a few rolls of crêpe paper are the essentials.

The Xmas colors are red, green and white. Snow effects are readily created with cotton and common salt.

Figure 1. A very simple filter arrangement that will eliminate the interference from thermal controlled blinkers.



Snow on a Xmas tree or the cap and shoulders of a Santa Claus can be simulated with flake camphor or artificial snow which can be obtained in the five-and-ten cent stores.

It is not enough merely to have sets on display. Everyone else in the business will be doing just that. Obtain ten yards or so of wide red ribbon. "Tie-up" a few receivers in gift fashion, running the ribbon diagonally across the front of the cabinet. A bit of rubber cement will hold it in place and do no damage to the cabinet. Attach large Xmas cards to the ribbons — "Merry Xmas" — "Merry Xmas to The Family"— "Merry Xmas to All!" A more pointed sales suggestion might be attached to say a small table model and read "Merry Xmas to Dad—for his den!"

Make up some cards in easel form, and stand these on several receivers, on the counters and in your show window. Suggested wording is— "OUR XMAS PRESENT TO YOU" —One year's free service on all sets bought before the first of the year!

Sidelines

Consistent with the buying boom, sideline sales run into large figures during the holiday season. A questionnaire recently sent to servicemen running small stores shows that *toys are the most profitable sideline with electric trains heading the list!* Biggest sales however are *Xmas tree lighting outfits* and *replacement bulbs. Electric toasters* and *waffle irons* are next in order. *Cameras*—still and movie—and *projectors* selling for under $20.00 also sell well just before Xmas and during Xmas week. Other more or less standard sidelines, such as electric irons, electric curling irons, flashlights, refrigerators and washing machines do not sell as well at this time and it is desirable that they be temporarily relegated to the background and the space used for display of radio and more appropriate Xmas sidelines.

Animation

Animation contributes much to any display, and Xmas material offers considerable opportunity for inexpensive animation. Red, green and amber lights can be blinked with low cost thermal blinkers. If a Xmas tree forms a part of the display, the lights on the tree can be similarly blinked. (If you are running set demonstrations and the blinker causes interference, try the simple filter shown in Figure 1. However, the blinker will seldom kick up a racket if a good noise reduction antenna is used in the store—as should always be done.)

About the most effective bit of animation is an electric train. Nothing will more quickly gather a crowd—young and old, male and female—and hold it! The display is really double-barreled in that it also forms a very profitable item for sale. The same applies to any other electrically operated toys.

Merry Xmas—and a profitable new year!

THE MONTH'S SERVICE SHOP

FOR the second time within a few months England is represented in this department — and incidentally from the same city of Manchester. Thomas A. Greenhalgh, Ltd., sends us the photograph of Figure 2 which speaks quite adequately for itself. Writes Mr. Greenhalgh—

"As our work is almost entirely done for the trade, a most exacting standard has to be maintained—such a standard that we cannot devote our time to anything other than service, and we claim to be the only firm operating in this country solely on radio repairs. To insure the high standard

Figure 4. Oscillogram of faulty radio with gain full on.

Sales

By Zeh Bouck

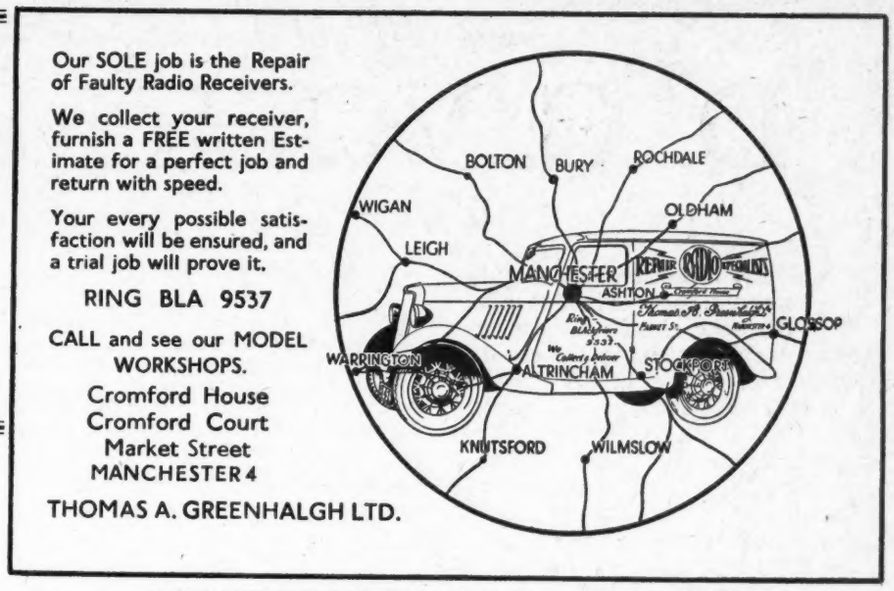
Service Editor

of work required, we make it a rule that no engineer can work longer than a period of 44 hours weekly. We found from experience that when an engineer is overworked he suffers from loss of interest in his work, and the standard deteriorates accordingly. In order to stock efficiently the huge number of American, English and continental valves (tubes) required for service work, we have had to arrange these in special trays on a separate portion of our premises, so that it is only a matter of seconds for an engineer to pick out the correct replacement valve. We are now in the process of installing sound and static-proof test rooms so that every possible test can be made to insure satisfaction."

Figure 3 shows the advertisement appearing on the reverse side of Figure 2.

The Floor Plan

Many servicemen and small dealers obtain radios for sale on what is known as a "floor plan." Most of the well-known makes can be obtained in this way, and distributors will furnish full information. Usually the serviceman or dealer pays 10-percent cash for the receivers—paying in full as they are sold. At the end of three months if not sold, he pays another 10 percent. At the end of six months he pays a third 10-percent, and 10-percent monthly after that until the receivers are sold or the full price paid up. This makes it possible for the small store to show a presentable line of receivers without entailing a large financial investment. However, the plan has its disadvantages, and the serviceman should work for a reasonable contract. The receivers are delivered for "floor use" only—hence the system is known as the floor plan. This means that the receivers cannot be removed from the dealer's floor—and a representative of the company comes around every few days (usually at unexpected times) to check up and see that all the sets are on the floor. Should one of them be missing, the dealer must pay in full immediately for that receiver. This means that a set cannot be removed to a prospect's home for a demonstration—which sometimes kills a sale. Needless to say most dealers disregard these conditions at their own risk—and occasionally get stuck. We suggest that the serviceman, before signing on the dotted line, negotiate for a half-way reasonable floor plan.



HOW ONE SERVICE ORGANIZATION GETS BUSINESS

Figure 3. The reverse side of the photograph of Figure 2. The two sides form an excellent advertisement. Slipped in the mail box or under the door, this card always makes a good impression and "makes service sales."

THE SERVICE BENCH

R. O. L., of New Brunswick, Ga., writes in and reports trouble with a—

Browning—35

"The receiver is dead, and one can usually smell smoke after attempted operation for a minute or so. The audio is okay as can be readily determined by touching the grid cap of the second detector tube. I have had several of these sets in with the same trouble which is due to a shorted .05 mfd. by-pass condenser from the plate supply to the cathode of the first detector. This puts a high potential across the first-detector cathode resistor (350 ohms) which will burn this out if the current is left on very long. It is a good idea to check this resistor when replacing the condenser."

Common Ailment

"I have found the trouble to be described common to many receivers. It was discovered accidentally when checking for a short-circuited condenser by the resistance method with

(*Turn to page* 422)

Figure 6. After realignment — with the receiver in perfect condition. Ordinarily the receiver would have been returned to the customer in the condition that made the curve shown in Figure 5. The customer can thank the oscilloscope!

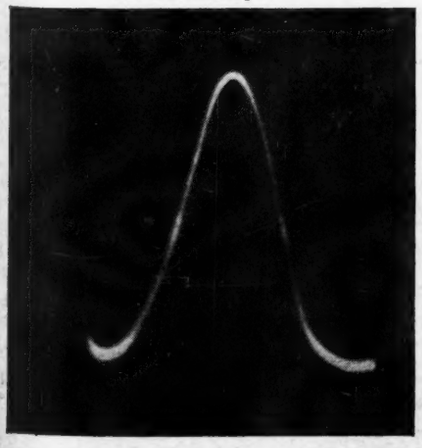


Figure 5. Normal gain and with the main trouble removed.

Servicemen! Dealers!

HAVE you a well-equipped shop, neatly and efficiently laid out? Or an attractive and effective Window Display, Sales Counter, Demonstration Room, or Service Bench? If so, send in a photo, with a short description, for publication. After using it, you can have the cut, free of charge.

Here is a chance to obtain an expensive cut, gratis, suitable for any literature or newspaper advertising you have in mind.

Send photos and captions to the Service Editor, RADIO NEWS, 461 Eighth Avenue, New York City.

A 100,000 Ohms-per-Volt D. C. VOLTMETER *That You Can Build*

THE simple yet exceedingly practical voltmeter described here permits accurate measurements in critical circuits and enables tracking down obscure troubles in high-resistance circuits which otherwise are almost impossible to locate.

By Gerard J. Kelly

OFTEN it becomes necessary to measure voltages in high resistance d.c. circuits without upsetting the conditions in the circuit. Such, for instance, as in checking the voltages in resistance-coupled amplifiers, a.v.c. and a.f.c. systems. This requires a voltmeter with an extremely high "ohms per volt" rating, which places a negligible load on the circuit. Such an instrument is the vacuum-tube voltmeter.

The unit described here is a vacuum-tube voltmeter for d.c. only. It employs one type 30 tube, is battery operated and does not require calibration. It provides 8 ranges. Four of them present infinite impedance; 0-5, 10, 50, 100 volts. The other four, 0-25, 50, 250, 500 volts, present impedance of 50 megohms. One zero adjustment is sufficient for use throughout any one range. The accuracy of the instrument is approximately 3% of full scale deflection when adjusted by comparison with an accurate standard.

Linear Scale

In the design of a vacuum-tube voltmeter for d.c. rectification is not desired and the tube must be operated on the straight part of its characteristic, as a class A amplifier. In this particular application it was desired to have a wide range and to make the range linear. This is accomplished by placing a load resistance in the cathode circuit (or B– lead), making the tube degenerative. Such a scheme straightens the characteristic of the circuit, and when a fairly straight portion of the characteristic has been picked in the first place, there is no difficulty in making the meter scale linear. The circuit is shown in Figure 1. The different ranges are obtained by changing the bias resistor. The steady plate current is bucked out by means of an opposing voltage obtained from the filament battery through potentiometer R13, which provides the zero adjustment and the resistors, R8, R9, R10, R11. By proper selection of these resistors and the bias resistors any desired range can be covered. Both groups are switched by a common two-deck switch. Zero adjustment must, of course, be made with a closed grid circuit, which necessitates the inclusion of switch S3. The maximum voltage that can be measured by the above described system must necessarily be lower than the B battery voltage or cause grid current to flow.

In order to multiply the ranges, the voltage divider R1-R2-R3 is used which places 50 megohms across the input terminals and connects the grid of the tube to the 10-megohm tap. Thus all ranges are multiplied by 5. Any other multiplication of ranges can be obtained by suitably choosing the values of dividing resistors.

Switch S2 cuts in the voltage divider in position B while the input terminals connect directly to grid when S2 is in position A. A reversing switch, S1, is included.

The accuracy of the instrument depends on: 1, the accuracy of the calibrating means; 2, the accuracy of the indicating meter; 3, the value of the bias resistor and possibility of securing the exact value of resistance. If care is taken in adjustment it is possible to make this instrument accurate to within 3% of full scale reading for each range.

Variations due to the running down of batteries are mostly compensated for by means of the zero corrector but there is a possible maximum error of ½% introduced by A battery voltage variations if the unit is adjusted initially at a filament voltage which is the average of the useful life of the battery. The A battery should be replaced when the voltage on the filament has dropped to 1.2 volt while the B battery should not be permitted to fall below 110 volts. The plate current drain on the various ranges in the "check" position is: 2.25 ma. for the 5 volt range, 1.1 ma. for the 10 volt range; 0.27 ma. for the 50 volt range and 0.14 ma. for the 100 volt range. At full scale reading the plate current is 1 ma. more than the above values.

AS NEAT AS IT IS PRACTICAL

Easily portable and completely self-contained, this instrument finds a wide range of utility in the shop and laboratory.

Easily Built

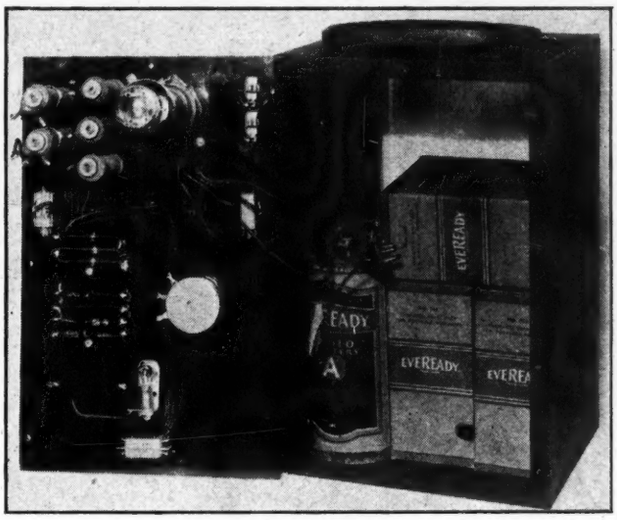
The construction is very simple and is well illustrated by the photographs. A standard Par-Metal cabinet is used, but with the front replaced by a bakelite panel. All the bias resistors, the filament resistor and the tube are mounted on a bakelite sub-panel which in turn is mounted on posts.

These posts are held in place by the meter mounting screws. The bias resistors are of the adjustable type and are so arranged that the slides are easily accessible. The socket must be positioned so as to have the two filament holes vertically above each other in order to prevent the filament from sagging against the grid when the tube is horizontal.

The zero correcting resistors R8, R9, R10, and R11, the series resistor for the pilot lamp and the multipliers for the B range are mounted on a second strip of bakelite over the switch S5. These resistors consist of several of the carbon type in series and were selected from a generous supply so as to obtain the odd values required. An accurate ohmmeter should be used for their selection. If a large supply of such resistors is not available it is better to employ the adjustable type of resistor (type ABA of IRC) and set them for the correct value indicated in the parts list.

The batteries are mounted in the case as shown in the photograph, use being made of fiber paper between the batteries. A block of wood is wedged between the upper wall of the case and the battery to prevent them from moving (not shown in the photograph.)

No part of the circuit is connected to the case but B– can be "grounded" to the case through a condenser, shown dotted in Figure 1.



THE INSIDE ASSEMBLY

All parts are mounted on the Bakelite front panel. The case serves as a container for the batteries.

Initial Adjustments

A good grade of hook-up wire should be used to keep the input resistance high and prevent moisture absorption. The values of the resistors given in this article apply to a unit employing the type 421 Triplett 0-1 ma. meter and an RCA type 30 tube. Equivalent material of different manufacturers may require slight changes in the values.

To adjust the instrument, set it up with its batteries outside the case. Adjust the filament voltage to 1.6 volts for the duration of this process. Use an extra resistor in series with R14 temporarily if necessary. Next obtain a source of voltage variable from 1 to 100 volts; this can consist of B batteries and a high-resistance potentiometer. The most accurate voltmeter available should then be connected across the supply and the voltage adjusted to 5 volts with the voltage supply connected to the input terminals of the unit and the switch S3 in the A position. Keeping S3 on "check" adjust R8 (if it is variable, otherwise R13) until the meter reads zero. Then throwing S3 to "operate", thereby placing exactly 5 volts on the grid, adjust R4, until the meter reads exactly full scale. The last adjustment has reacted on the first, so again set S3 to "check", adjust R8 (or R13) for zero, again set S3 to "operate" and adjust R4 for full scale deflection. This should be repeated until the meter reads zero in the "check" position and full scale in the operate position without having to make any more adjustments. Intermediate checks can be made at 0.1 full scale reading, etc., by comparison with the standard voltmeter. The adjustment is now complete for this range.

Using the Voltmeter

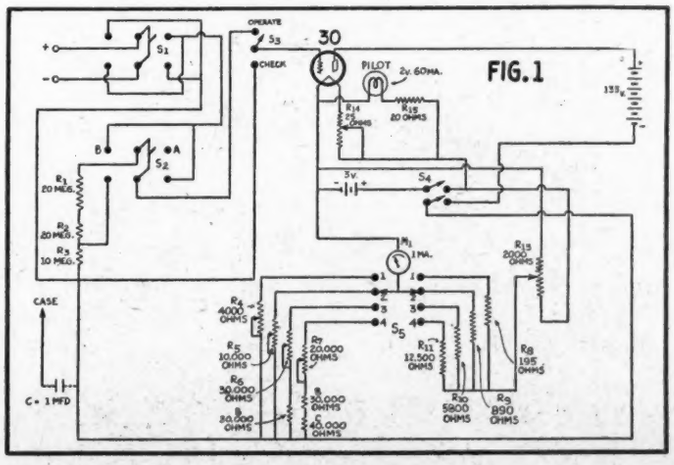
Next adjust the voltage supply to 10 volts, set S5 for the 10 volt range and adjust R5, R9 (or R13) for this range. Repeat the same procedure for other ranges. The accuracy of the B ranges can be checked by comparing a 100 volt reading on the A range with that on the B 500 volt range. If possible resistors should be selected so as to make the readings of the B range correct.

The values given in the parts list are those of the final adjustment of the model unit.

In order to prevent damage to the d.c. voltmeter, one should always start with the highest voltage range when measuring an unknown potential. Also, an open grid circuit causes the grid to assume a negative charge which will make the meter go off scale on the lowest range. Therefore, before making a measurement, adjust R13 with S3 in the "check" position, with S5 on the 500 volt range and S2 on B. Then connect the circuit to be checked to the input terminals. Now move S3 to "operate" and read the voltage. Lower ranges can then be used if the voltage proves to be low. In all cases, the circuit to be measured, when A scales are used, should be connected to the unit before S3 is set to "operate" and it should have a complete d.c. path. When a very high resistance is introduced in the circuit under measurement, the minute ionic currents, due to gas inside the tube, will cause a voltage drop across this resistance introducing an error. This error reaches a magnitude of 5 percent when the external resistance is 50 megohms. For ordinary values it is negligible.

For D. C. Only

This voltmeter is not suitable for a.c. measurements. When a.c. is superimposed on d.c. the instrument will read the d.c. component only, with an error which reaches a maximum of 2 percent when the peak voltage of the a.c. component equals the d.c. component. If the a.c. is larger than the applied d.c. voltage readings are unreliable.



Parts List

R1, R2—IRC carbon resistors, type BT1, 20 megs., 1 watt

R3—IRC carbon resistor, type BT1, 10 megs., 1 watt

R4—IRC wire-wound resistor, type ABA, 4000 ohms., 10 watts, set at 3200 ohms.

R5—IRC wire-wound resistor, type ABA, 10,000 ohms., 10 watts, set at 7400 ohms.

(*Turn to page* 431)

Important Points in Designing a SET TESTER

THE design of service test equipment, as far as the electrical circuits are concerned, follows regular formulas. In this article we describe a modern set tester and endeavor to show how each of the circuits were calculated.

In Figure 1, this set tester is shown. Antique bronze panel, golden oak carrying case and brown moulded bakelite panel parts form a combination both pleasing to the eye and intensely practical—well able to stand the everyday bumps and knocks of service use.

The new Supreme-Westinghouse meter is used in this model with a choice of either a 1 ma. (1000 ohms-per-volt) or a 40 microampere (25,000 ohms-per-volt) movement.

Single Control

Only one master selector switch is used so that all functions and ranges are available at once by a mere twist of the wrist. All functions and ranges, except those associated with the ohmmeter, are terminated at the pin jacks on the left side of the panel, whereas the ohmmeter functions and ranges terminate at the pin jacks on the right side of panel, with the "megohms" pin jack between the two rotary controls.

Two additional toggle switches are provided. The one on the left side of the panel is thrown to either the ac. or the dç. position, depending upon the functions desired. The right toggle switch is a momentary type normally being in the down position. This switch is used in the ac. voltage and megohms circuits.

Having described the panel appearance of this set tester, let us examine the complete schematic circuit diagram (Fig. 2). This is for the 1 ma. meter movement and shows a total of 20 functions and ranges as follows: 4 ac. voltage ranges of 0/7/140/350/1400; 4 dc. voltage ranges of 0/7/140/350/1400; 4 output ranges of 0/7/140/350/1400 ac. volts; 3 dc. ma. ranges of 0/7/35/140; 3 resistance ranges of 0/200/2,000/20,000 ohms and 2-megohm ranges of 0/2/20 megohms.

Rugged Meter

In Figure 3 we note a reproduction of the meter's scales. It will be readily apparent that only 4 basic scales take care of all functions and ranges. Thus, ac. voltages do not require "zig-zag" or "off-set" non-linear scales, but—due to the patented Isograd circuit, these indications are perfectly linear.

It may also be noted that the ohmmeter scale has been so designed that all ranges are decimal ratios of the basic 0/2000 scale. For instance, indications for the 0/200 range are divided by 10, indications for the 0/2000 range are read direct, for the 0/20,000 scale multiplied by 10, etc. Due to the excellent scale distribution, the first indication on the low ohms range is *0.1 ohms* and 3.5 ohms is *center scale!* This gives an extremely satisfactory range for testing low resistances such as encountered in voice coils, rf. coils, rf. chokes, etc.

The 0/7/35/140 basic voltage and milliampere scales are used in a similar manner. For the 0/350 range, the indication is read on the 0/35 scale and multiplied by 10; for the 0/1400 range, the indication is read on the 0/1400 scale and multiplied by 10.

Just a word about the meter movement as this is the foundation upon which all metered instruments are built. This rugged meter utilizes a sword type pointer which combines readability with strength. The meter movement proper is of the high torque variety, heavily damped and utilizing a hi-permeability magnet with welded pole tips.

Accuracy Assured

Any meter movement will have some value of internal resistance and this will vary between individual units of like model and sensitivity. The 1 ma. movement used in this Set Tester has an approximate internal resistance of 90 ohms. So that all values of resistors used in functional circuits can be pre-determined, the internal resistance of the meter is combined with a special, wire wound, external resistor to a total value of exactly 300 ohms. In other words, if the meter's internal resistance is 95 ohms, the external resistance will be wound to an accurate value of 205 ohms so that, in combination, they will total 300 ohms. This is shown in Figure 4.

To help in the calculation of the various circuits, sectional schematic diagrams are given showing just the parts used for that particular function.

Figure 5 shows the sectional dc. voltage circuit. The "ac.-dc." toggle switch is thrown to the "dc." position and the master selector switch rotated to the range desired.

Now, whether the meter movement is calibrated in terms of volts, milliamperes, microfarads, decibels, etc. *the movement always measures current.* When used as a voltmeter, it is connected in series with an external high resistance of a precomputed value and when used as a milliammeter it is connected in parallel with some pre-computed relatively low value resistor.

When a meter has a full-scale reading of 1.0 milliampere, the required series resistance necessary to make the meter read 1 volt at full

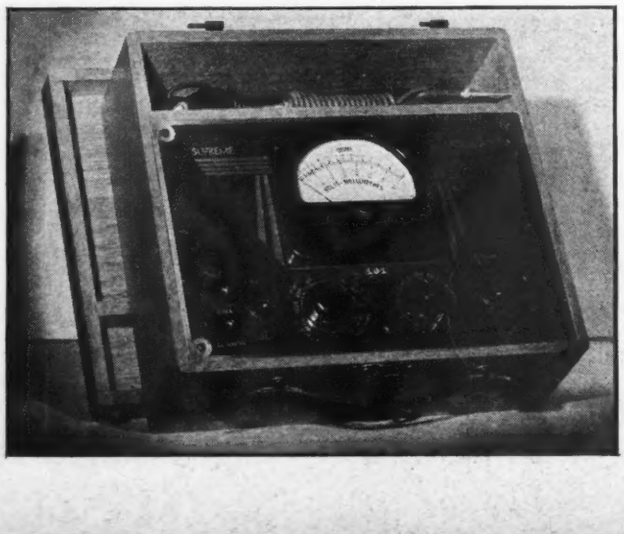
THE author, as Service Engineer of the Supreme Instruments Corporation, is well qualified to discuss the problems and point out the solutions in set-tester design. Servicemen, who regularly use such apparatus, will find many points in this discussion that will be helpful toward a complete understanding of its use. Others, who would want to build a set tester, will glean useful information that will help them in their own designs.

By Sam'l C. Milbourne

Part One

A MODERN INSTRUMENT OF MANY USES

Figure 1: The set tester, with its cover removed to show the control panel, including meter, the master selector switch, the zero adjuster, and other controls. At the top is a compartment for the test leads.



scale deflection is 1000 ohms. This is its "ohms-per-volt" designation and is equal to the total internal resistance of the meter plus the external series resistor, or R_T, divided by the required maximum voltage for full scale deflection. In other words:

$$R_{PV} = \frac{R_T}{E_T} = \frac{300}{.3} = 1000 \text{ ohms-per-volt}$$

as we know the "R_{PV}" value, the "R_T" value for any stated "E_T" will be $R_T/R_{PV}=E_T$ which is the same as saying, in this case, that the total circuit resistance necessary for any definite range is equal to the product of 1000 times the range's full scale value.

Applying the Formula

Let's see how this works out in practice.

For the 7 volt range, we would require a total of 1000 times 7 or 7000 ohms. The internal meter resistance plus its external resistor equals 300 ohms so we only have to add 6700 ohms and we have our total of 7000 ohms. For the 140-volt range, we require 140,000 ohms. We have 7000 ohms so if we add 133,000 ohms we have our correct total series resistance. For the 350-volt range we add 210,000 ohms—140,000 ohms leaving a balance required of 210,000 ohms to make up our required 350,000 ohm total. For the 1400 volt range, we require 1,400,000 ohms. We have 350,000 ohms and therefore require the difference or 1,050,000 ohms.

The Current Ranges

When using a meter to measure accurately the current passing through any circuit, all the current must pass through the meter or be by-passed by the use of a "shunt" as shown in Figure 6. Inasmuch as a 1 ma. meter movement requires but 1 ma. of current to indicate full scale, if higher current values are measured, the excess current must be shunted around the meter. For the 7-ma. range, we will want 1 ma. flowing through the meter and 6 ma. through the shunt. As the total meter resistance is 300 ohms and we want the shunt to carry 6 times the current passing through the meter, we will make the shunt value 1/6 the total resistance of 300 ohms or 50 ohms. For the higher current measuring ranges, the 50-ohm shunt resistor is tapped in two places forming what is known as a "ring type" shunt, the ring resistance being a total of all resistances (300 ohms meter resistance plus 40 ohms plus 7.5 ohms

(*Turn to page* 446)

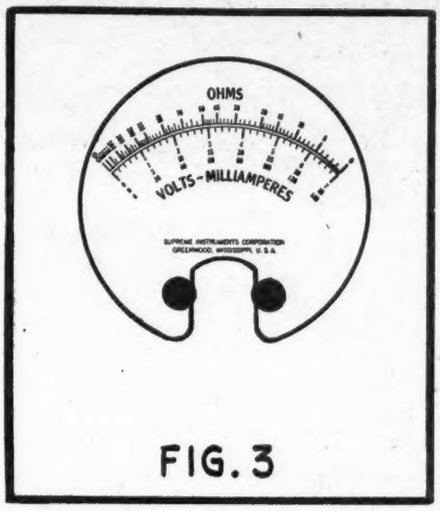


FIG. 3

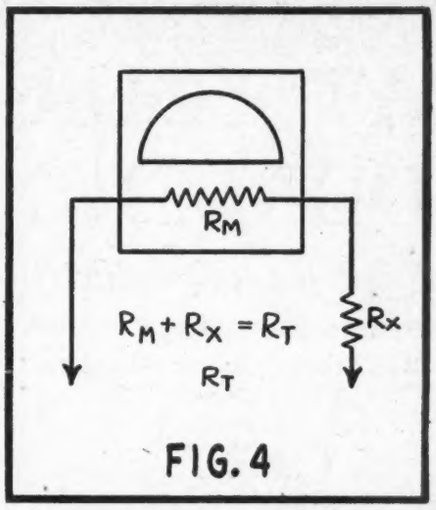
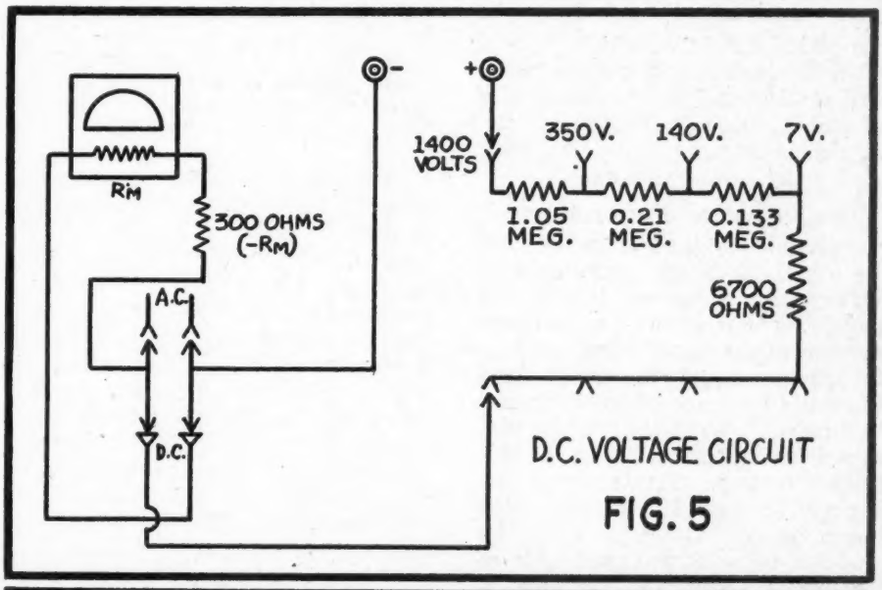


FIG. 4



D.C. VOLTAGE CIRCUIT

FIG. 5

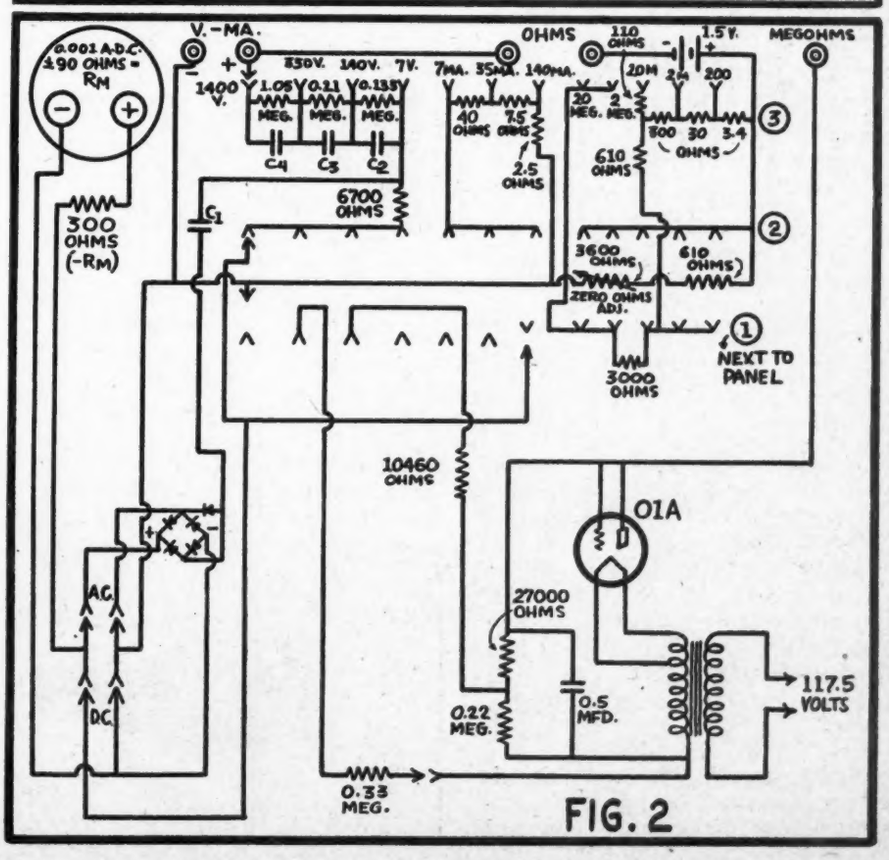


FIG. 2

See Them AT YOUR DEALER'S

(New Radio Products)

MAKING CATHODE-RAY TUBES FOR TELEVISION RECEIVERS

When television comes, in America in a permanent commercial way, the demand for cathode-ray tubes here will be sensational. It will call for trained engineers and hundreds of specialized operators to make the delicate parts on them, to assemble them and to test the finished product. Scene shows workers assembling tubes for the Phillips factory in Holland.

For Servicemen and Dealers

The General Cement Mfg. Company just brought out a new radio cabinet and refrigerator patch kit. It is a very handy kit for filling in deep nicks and scratches in radio cabinets and it is equally applicable for patching plastic and bakelite cabinets and white refrigerators. It consists of six shellac sticks in light and dark shades of walnut, oak, also black and white, an alcohol lamp, a spatula, steel wool, sand paper, and a wiping cloth.

New Vibrator Power Supply

In response to the insistent demand for a vibrator power supply suitable for use on airplanes, busses and motor boats for powering radio transmitters, receivers, and direction-finding equipment, P. R. Mallory and Company have announced their new "Vibrapack" model VP-G556, designed to operate from a 12-volt storage battery. This new unit delivers 300 volts at 100 ma. with three lower voltage outputs of 275, 250, and 225 volts instantly available at the turn of a switch. A synchronous vibrator is employed.

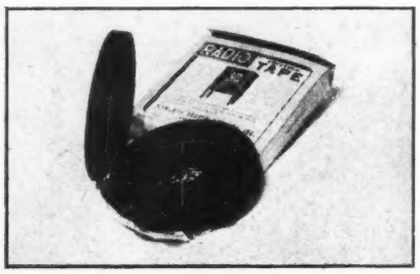
Double-Purpose Radio

The Sentinel "Rad-O-Fone" is a complete communication system with extension speaker, and as illustrated in the accompanying photograph is employed in conjunction with a

standard Sentinel radio receiver. The call system is designed for easy installation. It is of the wired type and the Rad-O-Fone unit plugs into the back of the radio chassis. The receiver features automatic tuning.

A Good Idea

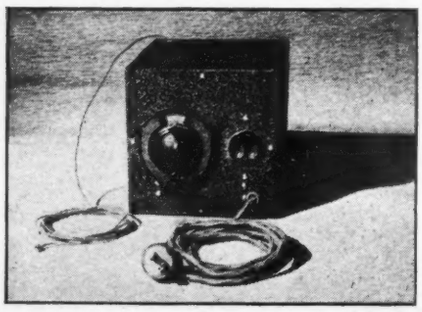
Radio servicemen and experimenters can recall the numerous occasions when a friction tape binding had to be made, it would be necessary to split the standard ¾ inch size tape in order to obtain a successful and neat wrapping. The Plymouth Rubber Company, realizing the need for a more convenient size tape, easier to handle and at the same time eliminating waste, recently introduced their new "Radio Friction Tape." As illustrated, the carton contains the regular ¾ inch "Slipknot" tape cut into two ⅜ inch rolls. It is a practical size applicable to most radio and electrical work. The manufacturer



points out that with this new tape a binding can be made directly from the roll, further eliminating waste.

Capacity Relay

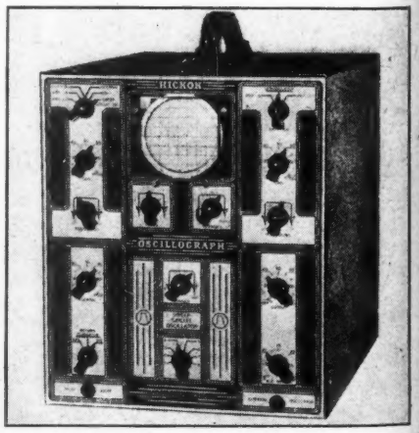
The Luxtrol Company is the manufacturer of the capacity-operated relay illustrated below. It operates on either alternating or direct current, its output is designed to handle loads



up to 800 watts. It is compact and is designed for easy installation and adjustment. This device offers a novel means for actuating advertising displays, protecting valuables, etc., and should prove an excellent side-line for servicemen.

Equipped with Latest Advancements

The new model RFO-4 oscillograph, recently announced by the Hickok Electrical Instrument Company, especially features a self-contained demodulator which enables stage-by-stage trouble shooting. A built-in electronic frequency modulator, operating on 665 kc. simplifies connections and makes possible selectivity measurements. Other features include a return trace eliminator, high sensitivity, horizontal and vertical amplifiers, rotatable cathode-ray



tube and simplicity of controls. The steel case measures 11 by 13 by 15 inches.

Latest Tube Checker

The new model "U" tube checker

(*Turn to page* 434)

An Easy-To-Build

80-Watt C. W. RIG

(Utah Kit No. 1)

By Oliver Read, W9ETI

YOU CAN DUPLICATE THIS

Compact, yet not crowded, this kit applies commercial principles of design to the home-built "ham" rig with the net result that appearance and operating effectiveness are well above the average.

IT has been and still is an almost universal practice among amateurs to build their own transmitter equipment. However, within the past year or two there has been a definite trend toward the use of kits, one of which is here illustrated and briefly described.

THIS kit, which has found a good deal of favor because it combines the features of low cost and high effectiveness, is the Utah Transmitter Kit No. 1. Starting with the No. 1 described here, other Utah kits can be added until a complete 500-watt phone and c.w. transmitter has been completed.

This kit No. 1 consists of a steel cabinet, two chassis and all parts as shown in the accompanying photographs except tubes, meters and crystal. The chassis are supplied with the sockets mounted in position and all holes drilled for mounting other parts. The construction job is, therefore, purely one of assembly and wiring, involving nothing more complicated than a soldering iron, a screwdriver and a pair of pliers.

The circuit of this complete transmitter kit is shown in Figure 1. The oscillator circuit is one of the regenerative, crystal control types which is highly stable and provides an abundance of harmonics. In spite of the use of regeneration, the crystal current is kept down to well within safe limits.

The r.f. amplifier employs two 6L6's, parallel connected, this type of circuit being favored as the one which provides a reasonably high output with minimum current consumption and with minimum excitation.

Reserve Power

Although this r.f. unit could be pushed to 100 watts input, no attempt is made to do this but instead the overall input is held to an average of between 80 and 90 watts which provides 60 to 72 watts output. Jacks are provided for measuring the various grid and plate currents to provide a complete check on operation. Later, should a modulator be added, the modulator output is simply plugged into the meter jack "J4" thus involving no changes in basic circuit of the r.f. kit. In such service, the r.f. plate current is measured by inserting the meter in the jack "J3". For c.w. operation, "J3" is the jack employed for keying.

Complete construction sheets are supplied to those purchasing the kit. In addition to other information, these sheets include complete winding data for all coils for the 20, 40, 80 and 160-meter bands. Operation on 10 meters is also possible, preferably using a 20-meter crystal.

Costs Little

The two photographs and the circuit diagram tell the story of this professional appearing kit which is well within the ability of any amateur to construct and put on the air. Not the least of its advantages is the fact that this kit with the necessary tubes, meters and crystal costs considerably less than medium grade receivers of the type used in amateur communication work. The transmitter kit idea is definitely here to stay now that its economy and efficiency are becoming more evident.

(Readers who desire information on the values of resistors, condensers, etc., shown in the circuit diagram may address inquiries to the author, in care of RADIO NEWS.)

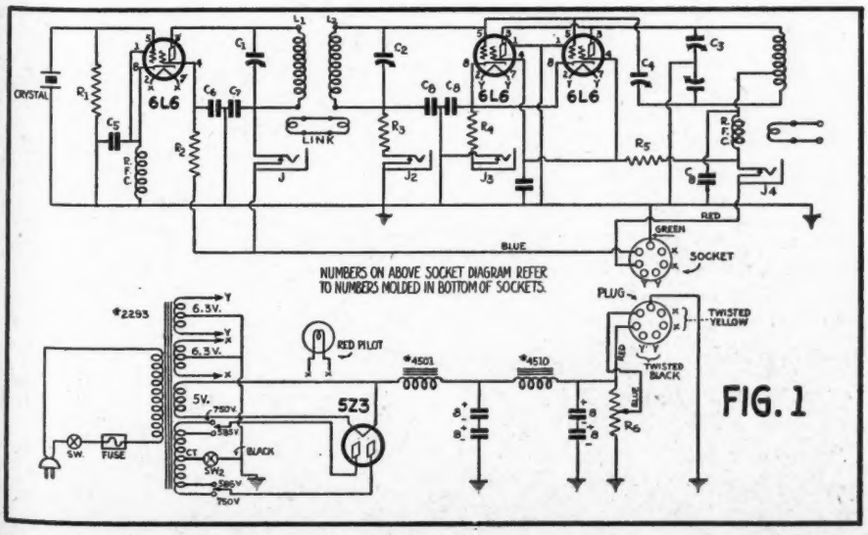
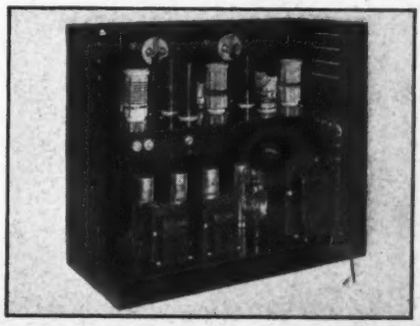
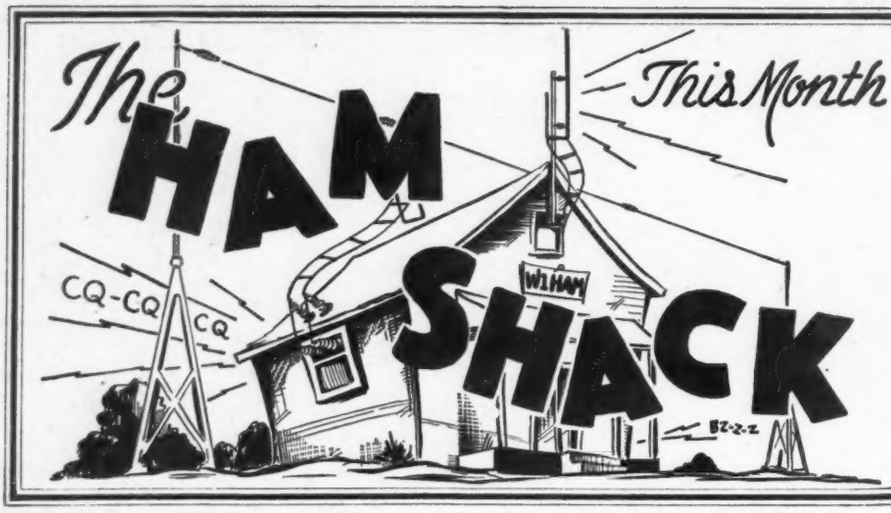


FIG. 1

NOTHING HAYWIRE HERE!

As neat from behind as from the front—and easy to duplicate because chassis is furnished completely drilled and with small parts mounted.





- Amateur Microphones
- Reproduction Quality
- Care and Handling
- Characteristic Tables
- The 833 Tube

Conducted by
E. M. Walker
Editor for Amateur Activities

The Matter of

"HAM" Microphones

"WHAT type microphone shall I use?" is a question frequently asked by the amateur contemplating phone for the first time. At the same time old-time phone men debate the merits of the many available types at great length. Each has his favorite, each has his prejudices. But when the question is reduced to its simplest form, it might be argued that regardless of how much is spent for a microphone it can be no better than the transmitter with which it is used.

ACTUALLY, as with everything else, there are good and bad microphones, but thanks to the progressiveness of manufacturers the bad ones are decidedly in the minority. Most of the microphones offered to the amateur today, ranging in price from more than $5 upward, are satisfactory. It is important, however, to remember that a good microphone used with poor speech equipment can sometimes sound much worse on the air than a poor one used with good equipment. The point is:

BRUSH MODEL BR2S

if the speech equipment is constructed to match the microphone used, good results can be obtained.

The microphone used in the amateur transmitter does not necessarily have to have the characteristics of a "broadcast" type in order to "sound good" over the air. The requirements for the transmission of speech do not make it necessary to "pick up" the high over-tones of music and the bass notes of an orchestra. Rather, speech frequencies are limited to a somewhat narrow margin on the audio scale, and sometimes a microphone that will faithfully reproduce these frequencies will sound better on the

STROMBERG NO. 5-SB

air than one capable of covering the wide range of the musical scale and thus pick up unwanted noises and "lip" characteristics.

In buying a microphone it is nice to have one that is capable of reproducing a wide band of frequencies for the personal satisfaction derived from having good equipment. Actually, however, a microphone that will faithfully reproduce audio sounds between 100 and about 3,000 cycles will perform satisfactorily on the voice of the average person. As a matter of fact a large number of amateurs now are incorporating in

NEW UNIVERSAL MIKE

their speech equipment audio filters designed to cut out frequencies below 100 to 200 cycles and above 3,000 cycles so as to obtain a higher average modulation level and at the same time keep the transmitter's sidebands at a minimum, thus reducing interference on the amateur phone bands.

One of the most popular type of microphone in use today is the crystal type which makes use of two plates between which a Rochelle salt crystal is mounted. This type of microphone (which was invented in England almost ten years ago) has become popular only within the last two years. It has a number of attractive features, principally among which are low cost, dependability, good quality, low noise-level and simplicity in connecting in a transmitter. Such microphones have output levels ranging from about minus 45 db to minus 100 db. With the variety of high voltage-gain tubes available today this comparatively low output level is not a disadvantage. They require an audio amplifier with an audio gain from 80 db to 120 db. With an amplifier capable of this amount of gain, driver and modulator tubes may be driven to full output.

Carbon microphones of both single and double-button types are still used by a large number of amateurs. The double-button types deliver far better

¶ A Department for the amateur operator to help him keep up-to-date

SHURE "TRIPOLAR" CRYSTAL

quality than the single-button types, although they are not quite as sensitive as the single-button units. However, the output level from a double button microphone is considerably higher than that from crystal microphones. The chief disadvantage of a carbon button is that it has an inherent noise due to the necessity of passing a low current through the carbon buttons in order to make it function. A double button microphone may be purchased from $5 to $50.

Next in popularity are the ribbon, condenser and sound cell (crystal) microphones. Most of these are more expensive than the types just mentioned, but are exceptionally good from a fidelity standpoint. The dynamic microphone operates on the same principle as the dynamic loudspeaker, only in reverse. The condenser microphone uses a tightly stretched sheet of metal spaced close to a solid plate, and converts sound into an audio component by the variations in capacity resulting from the audio impressed on the thin plate. The ribbon microphone, as its name implies, uses a ribbon suspended between two magnets which is caused to vibrate when an audio sound is impressed upon it, thus inducing variations in the electro magnetic circuit.

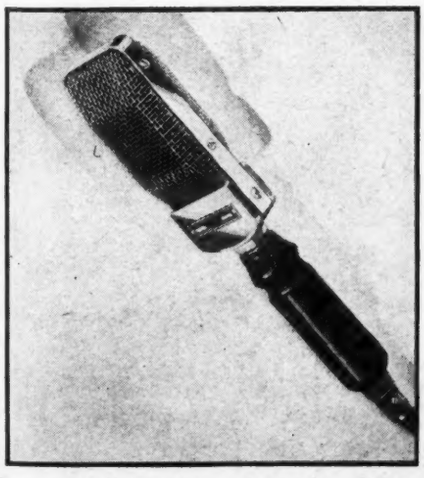
These three types of microphones range in price from about $15 upward with the top limit of types available to the amateur about $50. They are used by amateurs who have the best of equipment and glory in being classified as stations with "broadcast quality."

Microphones are perhaps the most delicate instruments used in a phone transmitter. Because they are constantly being handled, they are subjected to damage more than any other piece of equipment. Further, any slight damage due to a knock or fall may impair the quality of the unit, or put it out of commission completely. Good care is essential! When not in use, it should be protected with some sort of covering to keep dust and moisture out. It should not be exposed to places where extremes of temperature are to be encountered; it should never be exposed to high humidity or dampness unless it is especially designed for use under these conditions.

As much care electrically as mechanically should be given a good microphone. Carbon microphones particularly should not be given an overload of current. Excessive currents will freeze the carbon granules

(*Turn to page* 436)

BRUNO "VELOTRON"



ASTATIC MODEL D-104

The New

833 Tube

By **Robert Ames**

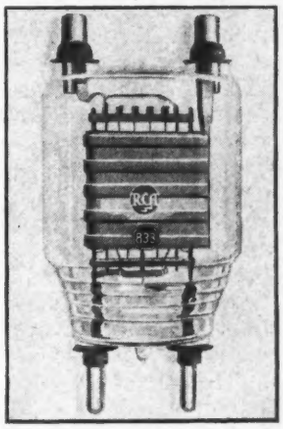
NEW tubes designed with the view of improving the efficiency of transmitting equipment are constantly making their debut on the market. With the tube equipment available today, the amateur has a choice that meets almost any requirement. Most recent among the new tubes is the 833 introduced last month by RCA. This tube is a high-output triode, designed for both medium and ultra-high-frequency operation. It may be used as an oscillator, radio-frequency amplifier or Class B modulator.

The tube is in the 1 kilowatt class. Its most unusual feature is its shape. It is a compact tube having grid and plate leads at one end and filament terminals at the other. Its design makes possible both short leads (within the envelop) and to the terminals of the tube in the circuit in which it may be used. The tube is round and about 8½ inches in length overall.

The tube has a plate dissipation of 300 watts and will take a maximum of 1,250 watts input, making it ideal for use in a single-tube, one-kilowatt amplifier stage. It is designed for operation at normal input, at frequencies up to 30 megacycles and will operate at 100 megacycles with slightly reduced input. Its ratings are:

Grid to plate capacity	6.3 mmfd.
Grid to filament capacity	12.3 mmfd.
Plate to filament capacity	8.5 mmfd.
Filament voltage	10 volts
Filament current	10 amperes
Maximum plate voltage	3,000 volts
Maximum plate current	500 milliamperes
Maximum grid current	75 milliamperes

The tube is a high-mu type, having



an amplification factor of 35. Its manufacturers claim in properly designed circuits plate efficiencies of 80-percent are possible. Also that it has a low driving-power requirement, 25 watts being sufficient to drive the tube at one kilowatt input.

The Radio News

"PROGRESSIVE" *Transmitter*

THIS modulator is designed around the versatile characteristics of the 6L6 beam tube. Under the Class AB2 mode of operation, a theoretical output of 55 to 60 watts is obtainable from a pair of these tubes under ideal operating conditions. This class of operation, however, is not recommended. In addition to requiring appreciable grid driving power there is also the necessity for a fixed bias voltage and tube life is shortened considerably.

For actual output powers in the vicinity of 60 watts a preferable arrangement is to operate four 6L6's in push-pull-parallel under class AB1 conditions. The advantages of self-bias operation and lack of necessity for grid driving power are retained while the output is higher, with less distortion than a single pair of 6L6's being pushed hard in class AB2 operation. The plate and screen voltages remain the same for both AB1 and AB2 operation while the current requirements are very nearly the same.

Simple Circuit Used

The use of four 6L6's in class AB1 lends itself nicely to our requirement for a modulator that will both economically and efficiently modulate the 807, and later the pair of T20's. For modulation of the 807 only two

60-WATT MODULATOR

This is the finished modulator. Temporarily two of the 6L6's are omitted as the other two provide more than ample power to modulate the low-power r.f.

THIS is the second of a series of four articles describing a high-grade transmitter, the construction of which can be spread over as long a period of time as desired but which can go on the air with the completion of the 2-tube, 25-watt exciter and its power supply, both of which were described last month. This month a modulator is described, the addition of which converts this exciter into a 25-watt phone rig. The third and fourth articles will describe the additional units necessary to wind the job up as a modern 110-watt phone transmitter for use on all bands from 10 to 80 meters, and even on 160 meters.

By Chester Watzel and Willard Bohlen

(Part Two—The Modulator)

of the 6L6's are used. As the current required is not much over a hundred ma. the 400-volt supply for the low-power r. f. unit can supply both this unit and the modulator. This saves an extra supply for low-power phone operation. For full audio output for later requirements, of course, all four 6L6's are used. A separate 400-volt power supply, to be described in the final article, is then used for the modulator alone.

There is, actually, very little to the modulator outside of the push-pull-parallel power stage. As the grids of the 6L6's require only voltage drive the voltage amplifier section of the modulator is quite simple. A single 6N7 is all that is necessary to do the job. This tube is the metal tube version of the more familiar 53 or 6A6. For the sake of clarity the 6N7 is shown in the modulator diagram as two separate tubes.

The two sections of the 6N7 are used as two separate resistance-coupled stages. The overall gain of these two stages is sufficiently high to swing the grids of the 6L6's from a standard type of crystal microphone, or from a Velotron which has even higher output than the crystal microphone.

As the two sections of the 6N7 are resistance coupled, audio transformers are required only in the modulator stage. By avoiding the use of transformers in the early stages we economize and at the same time eliminate a prolific source of hum, instability and feed-back.

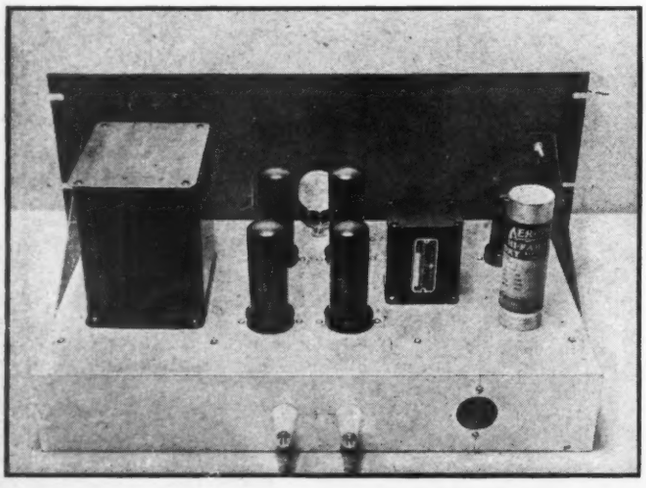
Several other circuit features are worthy of note. An r. f. choke is used between the microphone jack, J, and the grid of the first section of the 6N7. This removes any r. f. that may be picked up by either the microphone or its connection cord. A shielded plug should be used to eliminate any possible r. f. pickup at this point.

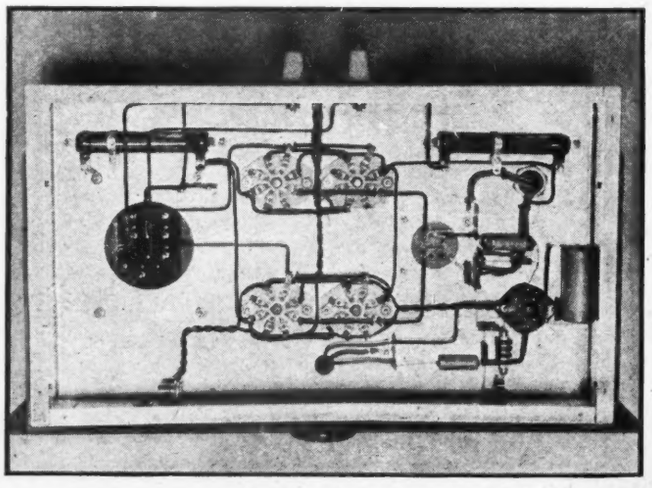
Thorough Filtering

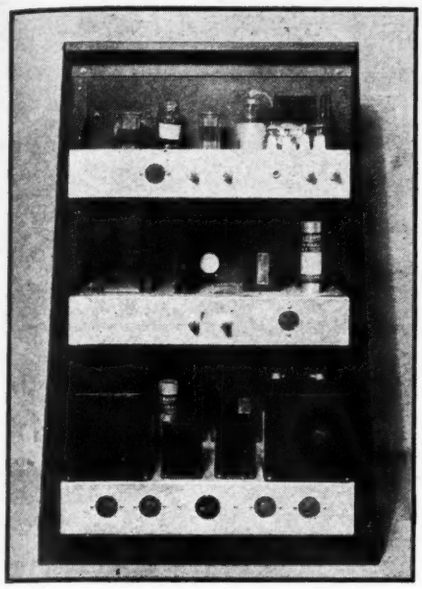
R3 and C2 form a decoupling filter for the 6N7 first section. Additional filtering is provided by R7 and C3. R7 also reduces the voltage for the

UNDER VIEW OF MODULATOR

A neat job and a well balanced layout. The two adjustable resistors permit alteration of screen and grid-bias voltages for two or four 6L6's.







UNITS INTERCHANGEABLE

Here, from top to bottom, are the r.f., modulator and power units of the low-power rig. Later the high-power final will be included in this rack and the modulator moved to a second rack.

plates of the 6N7 and screens of the 6L6's to approximately 300 volts. Although R7 has a slider, the full resistance value is employed when the modulator is run with two 6L6's. The same applies to the cathode resistor R6. These are both capable of handling the full current of four tubes.

Modulating Transformer

The Ken-O-Tap modulation transformer, T1, will handle up to 75 watts and will match any combination of modulator tubes to any r. f. load or low-impedance line. The plate impedance of a pair of 6L6 tubes in class AB1 is 6600 ohms, while the plate impedance of four tubes is 3800 ohms. As it happens, the primary taps stay the same for either combination of tubes; the plates to 4 and 6, B-plus to 2 and 5 which are joined together. One secondary connection may be permanently made to tap A. For use with two 6L6's modulating the 807 the other secondary connection should be made to tap C. Later, when all four tubes are used the only change in connections to this output transformer is to change from tap C to tap D.

Testing Modulation

For preliminary test of the modulator for a lamp bulb may be used to check the approximate output. A thirty-watt bulb (ordinary electric light type) is connected from tap A to tap B on the output transformer. This will give an approximate match from the modulator to the bulb. It should be possible to light the bulb to full brilliancy when whistling several inches from the microphone. Any standard type of high output (around minus 56 db.) crystal microphone has sufficient output to produce the full 30 watts of audio power from the modulator.

Rack and Panel

The photographs show the transmitter mounted in one rack for low-power phone operation. The rear view photo shows the 750-volt power supply built into place on the lower chassis, along with the 400-volt supply. This 750-volt supply is not, of course, necessary for low-power phone, but had been built into the model in order to permit tests to be completed before writing the next installment of this series.

For low-power c. w. operation the "modulator" terminals are shorted. For phone operation the jumper wire is taken off and the two terminals connected to the corresponding terminals immediately below on the modulator chassis.

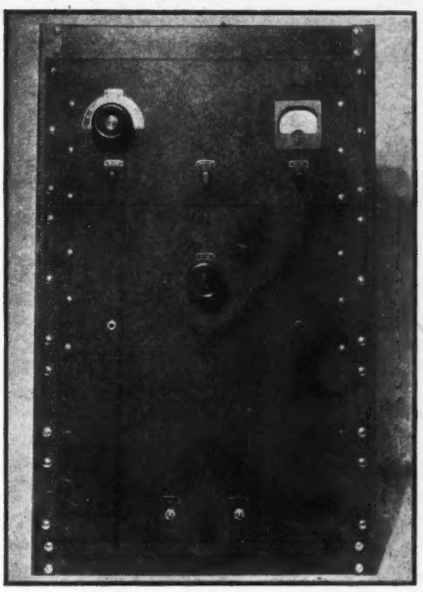
The full available output from the modulator with only two 6L6's in place is enough to cause severe overmodulation of the 807 carrier. This makes it important to check the modulation percentage and keep the gain turned well down to be sure that an overmodulation condition does not exist.

Keying Precautions

It might be advisable to mount a small knife switch across the modulator terminals so that they may be shorted when keying the transmitter for c. w. Keying thru an unshorted modulation transformer causes peak voltages to build up which are liable to cause bad key clicks and may damage the transformer.

For c. w. operation alone either the old or new types of 807 may be employed. For phone work, however, it is advisable to use one of the newer types which have a rating approximately 50 percent higher than the old. The old type is rated for only 325 volts on the plate for phone operation. For c. w. operation its rating is 400 volts.

Next month's article, the third in this series, will describe the 750-volt power supply and also the push-pull T20 r. f. stage. With this latter T20 stage mounted in place of the modulator unit, a complete 110-watt c. w. transmitter will be contained in the one single rack.



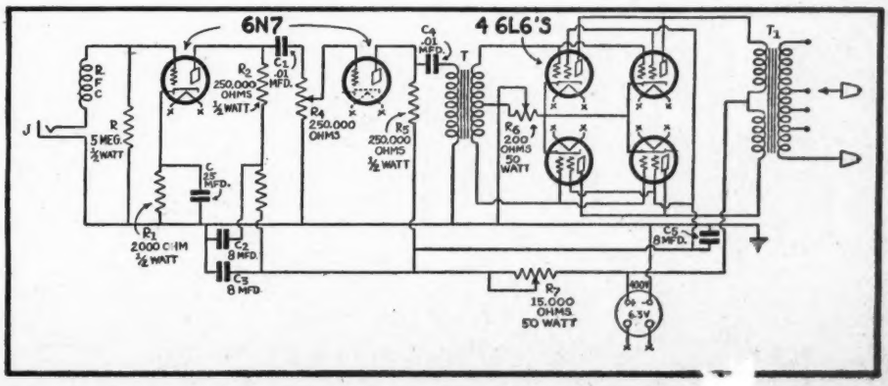
THE 25-WATT PHONE

The units described in this and the preceding article, mounted on a single rack as shown here, can be put in service pending completion of the high-power r.f. final and its power supply.

Parts List

C Aerovox electrolytic, 25 mfd., 50 v.
C1 Aerovox tubular, .01 mfd., 400 v.
C2, C3 Aerovox dual filter, 8-8 mfd., 450 v.
C4 Aerovox tubular, .01 mfd., 400 v.
C5 Aerovox filter, 8 mfd., 450 v.
J Yaxley type A-1 jack
R IRC 5 megohms, ½ watt
R1 IRC 2,000 ohms, ½ watt
R2 IRC 250,000 ohms, ½ watt
R3 IRC 50,000 ohms, ½ watt
R4 Yaxley type M 250,000 potentiometer
R5 IRC 250,00 ohms, ½ watt
R6 Ohmite type 0567 wirewound with slider, 200 ohms, 50 watts
R7 Ohmite type 0583 wirewound with slider, 15,000 ohms, 50 watts
RFC Hammarlund type CH-X r.f. choke
T Kenyon type T52 single plate to pushpull grids interstage transformer
T1 Kenyon type T494 Ken-O-Tap output transformer, 75 watts
2 Birnbach feedthrough insulators
4 Hammarlund type S-8 octal Isolantite sockets
1 Parmetal type 3604 panel, 8¾ by 19
1 Parmetal type TR-3220 table type relay rack

(*Turn to page* 431)



EUROPEAN STATION LIST

(For Medium and Long Waves)

Conducted by John M. Borst

ALBANIA

Call	Location	kc.	kw.
....	Tirana (under construction)	1384	.....

AUSTRIA

....	Innsbrueck	519	1.0
....	Vienna	592	100.0
....	Graz	886	15.0
....	Linz	886	15.0
....	Klagenfurt	1294	5.0
....	Vorarlberg	1294	5.0
....	Salzburg	1348	2.0

BELGIUM

....	Brussels I	620	15.0
....	Brussels II	932	15.0
....	Brussels	1122	0.1
....	Schaerbeek	1122	0.1
....	Libramont	1122	0.1
....	Antwerp	1465	0.1
....	Ghent	1464 & 1482	0.1
....	Loxbergen	1122 & 1482	0.1
....	Binche	1491	0.2
....	Chatelineau	1491	0.2
....	Courtrai	1491	0.1
....	Andrimont	1500	0.1
....	Liege	1500	0.1
....	Liege	1500	0.1
....	Liege	1500	0.1
....	Seraing	1500	0.1
....	Vellereille-le-Brayeau	1500	0.1
....	Verviers	1500	0.1

BULGARIA

....	Sofia	850	1.0
....	Varna	1267	2.0
....	Stara Zagora	1402	2.0

CZECHOSLOVAKIA

....	Banska Bystrica	392	30.0
....	Prague (Liblice)	638	120.0
....	Brno	922	32.0
....	Bratislava	1004	13.5
....	Moravska Ostrava	1113	11.2
....	Kosice	1158	2.6
....	Prague (Strasnice)	1204	5.0

DANZIG

....	Danzig	1303	0.5

DENMARK

OXP	Kalundborg	240	60.0
OXQ	Copenhagen	1176	10.0

ESTONIA

....	Tartu	517.2	0.5
....	Tallinn (Reval)	731	15.0

FINLAND

....	Lahti	166	220.0
....	Oulu	431	10.0
....	Viipuri (Viborg)	527	10.0
....	Pori (Bjorneborg)	749	1.0
....	Sortavala	776	0.25
....	Helsinki (Helsingfors)	895	10.0
....	Tampere (Tammerfors)	1348	0.7
....	Vaasa (Vasa)	1420	0.5
....	Turku (Abo)	1429	0.5
....	Pietarsaari (Jakobstad)	1500	0.25

FRANCE

Radio Paris	Paris (to be increased to 200 kw.)	182	80.0
Alpes-Grenoble	Grenoble	583	15.0
Lyon PTT	Lyons	648	90.0
Paris PTT	Paris	695	120.0
Marseille PTT	Marseilles	749	100.0
Toulouse PTT	Toulouse	776	120.0
Radio Agen	Agen	832	0.5
Radio Strasbourg	Strasbourg	859	100.0
Limoges PTT	Limoges (to be increased to 100 kw.)	895	1.5
Radio Toulouse	Toulouse	913	8.0
Poste Parisien	Paris	959	60.0
Radio Sud-Ouest	Bordeaux	968	2.5
Rennes-Bretagne	Rennes	1040	120.0
Bordeaux-Lafayette	Bordeaux (to be increased to 100 kw.)	1077	25.0
Radio Normandie	Fecamp	1113	0.7
Nice-Cote d'Azur	Nice	1185	60.0
Radio-PTT-Nord	Lille	1213	60.0
Radio-Mediterrannee	Antibes	1276	0.5
Radio-Cite	Paris	1348	2.0
Montpellier-Languedoc	Montpellier	1352	1.2
L'Ile de France	Paris	1366	0.7
Radio Lyon	Lyons	1393	25.0
Rueil-Malmaison	Paris	1429	2.0
Tour Eiffel	Paris	1456	5.0
Radio Nimes	Nimes	1492	0.7

GERMANY

....	Koenigswusterhausen	191	60.0
....	Muehlacker	574	100.0
....	Langenberg	658	100.0
....	Munich	740	100.0
....	Leipzig	785	120.0
....	Berlin-Tegel	841	100.0
....	Hamburg	904	100.0
....	Breslau	950	100.0
....	Koenigsberg	1031	100.0
....	Frankfurt on Main	1195	25.0
....	Freiburg	1195	5.0
....	Kassel	1195	0.5
....	Koblenz	1195	2.0
....	Trier	1195	2.0
....	Gleiwitz	1231	5.0
....	Goerlitz	1231	5.0
....	Saarbruecken	1249	17.0
....	Nurnberg	1267	2.0
....	Dresden	1285	0.25
....	Bremen	1330	2.0
....	Flensburg	1330	2.0
....	Hannover	1330	2.0
....	Magdenburg	1330	0.5
....	Stettin	1330	2.0
....	Stolp (under construction)	1330	...
....	Koenigsberg II	1348	2.0
....	Kaiserslautern	1429	0.5
....	Dresden (under construction)	1465	5.0

GREECE

....	Athens (under construction)	601	100.0

HUNGARY

HAL2	Budapest II	360	18.0
HAL	Budapest I	546	120.0
HAE	Nyiregyhaza	1122	6.25
HAE2	Magyarovar	1321	1.25
HAE3	Miskloc	1438	1.25
HAE4	Pecs	1465	1.25

ICELAND

TFU	Reykjavik	208	16.0

IRISH FREE STATE

....	Athlone	565	100.0
6CK	Cork	1240	1.0
2RN	Dublin	1348	0.5

ITALY

I1BZ	Bolzano	536	10.0
I1PA	Palermo	565	3.0
I1FI	Florence	610	20.0
I1RO	Rome I	713	120.0
I1MI	Milan I	814	50.0
I1GE	Genoa	986	10.0
I1BA	Bari I	1059	20.0
I1NA	Naples	1104	10.0
I1TS	Trieste	1140	10.0
I1TO	Turin I	1140	7.0
I1BO	Bologna	1222	50.0
I1RO3	Rome III	1258	1.0
I1BA2	Bari II	1357	1.0
I1MI2	Milan II	1357	4.0
I1TO2	Turin II	1357	0.2

LATVIA

YLZ	Riga	583	15.0
....	Madona	1104	50.0
....	Kuldiga	1258	10.0
....	Liepaja	1734	0.1

LITHUANIA

LYX	Kaunas	155	7.0
LYY	Klaipeda	565	10.0

LUXEMBURG

....	Luxemburg	232	200.0

NETHERLANDS

....	Kootwijk	160	10.0 120.0
PX-1	Hilversum	995	15.0 60.0

NORWAY

LKA	Vigra	253	10.0
LKO	Oslo	260	60.0
LKM	Tromso	282	10.0
LKI	Finnmark	347	10.0
LKH	Hamar	519	0.7
LKT	Trondelag	629	20.0
LKK	Kristiansand	629	20.0
LKF	Frederikstad	722	1.0
LKB	Bergen	722	1.0
LKD	Bodo	850	10.0
LKP	Porsgrunn	850	1.0
LKS	Stavanger	850	10.0
LKG	Narvik	1222	0.3
LKR	Rjukan	1348	0.15
LKN	Notodden	1357	0.25

POLAND

....	Warsaw I, (Raszyn)	224	120.0
....	Wilno	536	50.0
....	Katowice	758	12.0
....	Lwow	795	50.0
....	Poznan	868	16.0
....	Torun	986	24.0
....	Krakow	1022	1.8
....	Lodz	1339	2.0
....	Warsaw II, Mokotow	1384	7.0

PORTUGAL

....	Lisbon	629	20.0
CT1GL	Parede	1031	5.0
CT1BO	Lisbon	1348	0.05
CT1AN	Lisbon	1411	0.04
CT1DH	Lisbon	1411	0.05
CT1DR	Lisbon	1411	0.04
CT1EB	Lisbon	1411	0.04
CT1IV	Lisbon	1411	0.04
CT1MO	Lisbon	1411	0.04
CS1SR	Oporto	1411	0.03
CT1KM	Lisbon	1412	0.04
CS1IR	Oporto	1429	0.25
CS1BI	Oporto	1429	0.05
....	Oporto	1429	0.03
CS1RP	Oporto	1429	0.01
CS1RG	Oporto	1429	0.05
....	Oporto	1429	0.05
....	Oporto	1429	0.03
CS1AA	Lisbon	1492	0.04
CS1CF	Oporto	1492	0.03

RUMANIA

....	Bod (near Brasov)	160	150.0
....	Bucarest	823	12.0

SPAIN

It was found impossible to obtain complete authoritative data. The following list was compiled from several sources; changes may be expected at any moment.

....	Madrid	183	1.0
EAJ2	Madrid	731	3.0
EAJ5	Seville	731	3.0
EAJ1	Barcelona	795	7.5
EAJ3	Valencia	850	1.5
EAJ15	Barcelona	1022	1.0
EAJ19	Oviedo	1022	1.0
EAJ7	Madrid	1095	12.0
EAJ56	Salamanca	1095	....
EAJ8	San Sebastian	1258	3.0
EAJ28	Bilbao	1258	0.6
EAJ62	Vitoria	1420	0.2
EAJ4	Santiago de Compostela	1492	0.2
EAJ6	Pamplona	1492	0.2
EAJ9	Malaga	1492	0.2
EAJ10	Zaragoza	1492	0.2
EAJ12	Alcoy	1492	0.1
EAJ13	Palma de Mallorca	1492	0.1
EAJ16	Granada	1492	0.2
EAJ17	Murcia	1492	0.2
EAJ20	Sabadell	1492	0.2
EAJ21	Melilla	1492	0.2
EAJ23	Gandia	1492	0.2
EAJ24	Cordoba	1492	0.1
EAJ27	Burgos	1492	0.2
EAJ31	Alicante	1492	0.2
EAJ33	Tarragona	1492	0.2
EAJ34	Gijon	1492	0.2
EAJ39	Badalona	1492	0.2
EAJ41	La Coruna	1492	0.2
EAJ42	Larida	1492	0.2

Call	Location	kc.	kw.
EAJ43	S. C. Tenerife	1492	0.2
EAJ44	Albaceta	1492	0.2
EAJ46	Ceuta	1492	0.2
EAJ47	Valladolid	1492	0.2
EAJ48	Vigo	1492	0.2
EAJ51	Manresa	1492	0.2
EAJ52	Badajoz	1492	0.2
EAJ54	Alcira	1492	0.11
EAJ57	Orense	1492	0.2
EAJ58	Jerez Fra (Cadiz)	1492	0.2
EAJ60	Almeria	1492	0.2
EAJ61	Jaen	1492	0.2
EAJ65	Ciudad Real	1492	0.2
EAJ11	Reus	1500	0.2
EAJ14	Castellon	1500	0.2
EAJ18	Logron	1500	0.2
EAJ22	Huesca	1500	0.2
EAJ25	Tarassa	1500	0.1
EAJ26	Antequera	1500	0.2
EAJ29	Alcala de Henares (Madrid)	1500	0.2
EAJ30	Onteniente (Valencia)	1500	0.1
EAJ32	Santander	1500	0.2
EAJ35	Villanueva Geltru (Barcelona)	1500	0.2
EAJ36	Jativa	1500	0.2
EAJ37	Linares	1500	0.2
EAJ38	Gerona	1500	0.2
EAJ40	Pontevedra	1500	0.2
EAJ45	Denia	1500	0.04
EAJ49	Toledo	1500	0.2
EAJ50	Las Palmas	1500	0.2
EAJ52	Elche	1500	0.2
EAJ55	Algeciras	1500	0.2
EAJ63	Leon	1500	0.2
EAJ64	Segovia	1500	0.2
EAJ68	Lugo	1500	0.2

SWEDEN

SBG	Motala	216	150.0
SBE	Boden	392	0.6
SBF	Ostersund	413.5	0.6
SBD	Sundsvall	601	10.0
SBA	Stockholm	704	55.0
SCN	Malmberget	704	0.2
SBB	Goteborg	941	10.0
SCC	Falun	1086	2.0
SBH	Horby	1131	10.0
SCB	Eskilstuna	1240	0.2
SCP	Saffle	1240	0.4
SCU	Varberg	1240	0.2
SCV	Orebro	1240	0.2
SCL	Kiruna	1258	0.2
SBC	Malmo	1312	2.5
SCK	Karlstad	1312	0.25
SCO	Norrkoping	1312	0.25
SCQ	Trollhattan	1312	0.25
SCG	Halsingborg	1384	0.2
SCF	Hudiksvall	1402	1.0
SCS	Umea	1402	1.0
SCW	Ornskoldsvik	1402	0.5
SCE	Halmstad	1411	0.2
SCR	Uddevalla	1411	0.05
SCA	Boras	1447	0.2
SCI	Kalmar	1447	0.2
SCD	Gavle	1482	0.2
SCT	Uppsala	1492	0.2
SCM	Kristinehamm	1500	0.2
SCH	Jonkoping	1515	0.2
SCJ	Karlskrona	1530	0.2

SWITZERLAND

....	Geneva	401	1.3
....	Beromunster	556	100.0
....	Sottens	677	100.0
....	Monte Ceneri	1167	15.0
....	Basel	1375	0.5
....	Bern	1375	0.5

TURKEY

TAJ	Istanbul	186	3.0

UNITED KINGDOM

Droitwich National	Droitwich	200	150.0
North Regional	Moorside Edge	668	70.0
Scottish Regional	Westerglen	767	50.0
.... Burghead		767	60.0
.... Pennion		804	5.0
West Regional	Washford	804	70.0
London Regional	Brookmans Park	877	50.0
Northern Ireland Regional	Lisburn	977	100.0
Midland Regional	Droitwich	1013	70.0
Scottish National	Westerglen	1050	50.0
Newcastle	Newcastle	1122	1.0
London National	Brookmans Park	1149	20.0
North National	Moorside Edge	1149	20.0
West National	Washford	1149	20.0
Aberdeen	Aberdeen	1285	1.0
Bournemouth	Bournemouth	1474	1.0
Plymouth	Plymouth	1474	0.3

Call	Location	kc.	kw.
	U. S. S. R.		
RV1	Moscow	172	500.0
RV10	Minsk-Ko	208	35.0
RV4	Kharkov	232	10.0
RV8	Baku	238	10.0
RV43	Mc	271	100.0
RV7	Tiflis	283	35.0
RV3	Saratov	340	20.0
RV12	Rostov-on-Don	355	20.0
RV24	Smolensk	364	10.0
RV5	Sverdlovsk	375	40.0
RV21	Erivan	380	10.0
RV27	Makhach-Kala	390	4.0
RV49	Moscow	401	100.0
RV25	Voronezh	413.5	10.0
RV37	Ufa	436	10.0
RV45	Orenburg	461.5	1.0
RV41	Syktyvkar	472	1.0
RV34	Stalingrad	522	10.0
RV42	Gorki	565	10.0
RV36	Arkhangelsk	586	10.0
RV35	Astrakhan	598	10.0
RV31	Ivanovo	625	10.0
RV29	Petrozavodsk	648	10.0
RV23	Grozny	676	1.0
RV17	Kazan	686	10.0
RV48	Elista	704	2.5
RV16	Kuibishev	713	10.0
RV9	Kiev	722	35.0
RV65	Saransk	734	1.0
RV74	Cheboksary	740	5.0
RV64	Ordzhonikidze	749	10.0
RV78	Izhevsk	767	4.0
RV26	Stalino	776	10.0
RV51	Nalchik	794	1.0
RV39	Moscow	832	100.0
RV73	Simferopol	859	10.0
RV61	Ioshkar-Ola	888	1.0
RV30	Dnepropetrovsk	913	10.0
RV55	Engelsk	937	1.0
RV13	Odessa	968	10.0
RV67	Ukhta	968	2.0
RV86	Chernigov	1013	5.0
RV70	Leningrad	1040	40.0
RV33	Krasnodar	1050	1.0
RV57	Tiraspol	1068	4.0
RV75	Vinnitsa	1095	10.0
RV20	Kharkov	1185	20.0

YUGOSLAVIA

....	Ljubljana	527	5.0
....	Belgrade	686	2.5
....	Zagreb	1086	0.7

New Unit for

Testing Voices

By Samuel Kaufman

THE Columbia Broadcasting System has installed a radio device which permits actors to see their voices on an illuminated screen for the study of pitch, balance and other technical phases of their speech. The unit, known as the "Resonoscope," is a product of the Dumont Laboratories, and utilizes some television principles in operating technique.

Vibrations of the actor's voice or a series of tuning forks are fed into a cathode-ray tube through a crystal microphone used with a high-gain amplification unit. The wave-form seems to stand still when the horizontal sweep of electrons on the tube is the same as the vertical—or any multiple thereof. This occurs only when the frequency fed to the cathode valve is that of a given note.

A dial can be turned to one of twelve marks representing twelve

notes in one scale octave. With the dial on one marking, a stationary light pattern is shown on the screen and, simultaneously, the indicated note is hummed mechanically. A control then erases the pattern and to bring back the required design the actor must hum the designated note into a mike. If the note is given too sharp or too flat, the pattern, although reappearing, will move to the right or left. With the designated pitch and tone, however, the design remains stationary. The first application of the device was made on the Columbia Workshop series with Irving Reis using the Resonoscope for casting purposes.

Super-Audible Sounds

Boston, Mass.—An opportunity to explore a world of sound completely unknown to the average person will be given by Professor George W. Pierce in the new Harvard University series of programs to be transmitted over W1XAL, Boston, Mass., 6.04 mc., Tuesday evenings, beginning November 2nd from 8 to 8:30 p. m.

Changes in Division Personnel

Washington, D. C.—Chairman Frank R. McNinch, of the Federal Communications Commission, recently announced that Commissioner George Henry Payne was elected Chairman of the Telegraph Division, and that he had designated Commissioner T. A. M. Craven as a temporary member of this same division.

New Photo Tubes

New York, N. Y.—Three new phototubes have been made available by RCA. These are types 921, 922, and 923. Types 921 and 923 are of a new construction; they are smaller and double-ended which eliminates the base and provides a long insulating path between anode and cathode. The terminals at either end are so designed as to permit inserting each tube easily and positively in a clip mounting. Type 921 is a gas-filled tube designed for a maximum anode supply of 90 volts; the maximum anode current 20 ma. The sensitivity is 100 micro-amps per lumen at zero frequency, 97 micro-amps per lumen at 5000 cycles and 90 micro-amps per lumen at 10,000 cycles. Type 922 is a vacuum tube, designed for a 250 volt anode supply; its sensitivity is 20 micro-amps per lumen. Type 923 is similar in characteristics and construction to type 918 except for a shorter overall length. It is a gaseous tube with a sensitivity of 100 micro-amps per lumen with a 90 volt anode supply.

The DX for SHORT

Conducted by

THE BRITISH GUIANA BROADCASTING COMPANY.

Georgetown, British Guiana.

V.P.3M.R.

"THE VOICE OF GUIANA"

6,010 SOUTH AMERICA.

~~7000~~ Kc/s. 150 Watts.

We have great pleasure in verifying your report of reception of our programme on July 5-th, 1936.

Our present Schedule is—

Sundays 9 a.m.—11.30 a.m. 12.45 p.m.—3.15 p.m.

Week days 6 p.m.—10.00 p.m. 9.45 p.m.—1.45 a.m.

LOCAL TIME GMT

G. V. Griffiths, Sec

VERIFICATION CARD OF VP3MR

Our observer, Juan M. Salazar, of Cuba, sends us this unique verification card from the well known station at Georgetown, British Guiana.

THE Fifty-eighth installment of the DX Corner for Short-Wave contains the World Short-Wave Time-Table for 24-hour use all over the world and Official Observers' reports of stations heard this month. Consult these two items regularly and make your all-wave set pay big dividends!

Credit Where It Is Due

The "star" list of short-wave Listening Post Observers this month includes: Welper, Alfred, Fleming, G. C. Gallagher, L. F. Gallagher, Myers, Diez, Dressler, Shamleffer. Our congratulations to these Members for their fine attention to detail, their persistently good catches and well-prepared reports.

Reports of Listening Post Observers and Other Short-Wave Readers of the DX Corner

LISTED in the following columns is this month's consolidated reports of short-wave stations heard by our wide-world listening posts. Each item is credited with the Observer's surname. This allows our readers to note who obtained the information. If any of our readers can supply Actual Time Schedules, Correct Wavelengths, Correct Frequencies and any other Important Information (in paragraphs as recommended), the DX Editor, as well as our readers, will be grateful for the information. On the other hand, readers seeing these reports can try their skill in pulling in the stations logged and in trying to get complete information on these transmissions. The report for this month, containing the best information available to date, follows:

Europe

"Radio Norte," Spain, 7050 kc., 5 p.m. (Betances).

"Radio Requete," Madrid, Spain, 7100 kc., news at 4:30 p.m. (Betances).

"Radio Espana," San Sebastian, Spain, 7250 kc., daily from 4 p.m. (Betances); 10,250 kc., irregularly 6-9 p.m. (Fleming).

"Radio Journal," San Sebastian, Spain, 41.65 meters, daily 12:30 p.m. (Westman).

EAQ, Madrid, Spain, 9860 kc., Sundays 4 p.m. on, daily 7 p.m. (Fleming, Shamleffer).

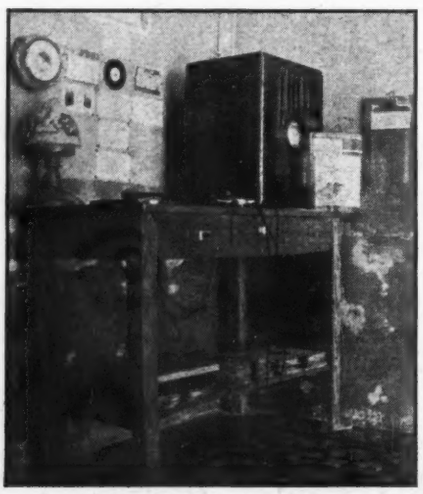
EAR, Madrid, Spain, 9478 kc., irregular 7:30-9:30 p.m. (Alfred); daily 6:30-8:30 p.m. and 10-11 p.m. (Markuson, Myers, Shamleqer, Diez); 10,400 kc. (Dressler), Slogan: "The Voice of Spain." Address: P. O. Box 951.

"Radio Bilbao," Spain, 7300 kc., daily from 4 p.m. (Betances).

"Radio National," Salamanca, Spain, 10,373 kc., daily 7:30-8:47 p.m., no call sign given but reports were requested (Alfred); 5-6:25 p.m. (Magnuson, Eder, Carroll, Nigh, Scala); 9-9:45 p.m.

WELL KNOWN OBSERVER

Observer Luis Diez, of Retalhuleu, Guatemala, sends greetings to Radio News listeners. He had heard all continents on his Philco 116-B, shown below.



(Sullivan, Dressler); 10,420 kc. (Gallagher, Kentzel, Poll, Markuson). Slogan: "Salute Franco; Arriba Espana."

"Radio Liberte," Paris, France, 9530 kc., announces in French and Italian. (Smith); signed 6:33 p.m. (Eder). Address: Radio Home, 10 Ave. de la Liberte, Becon Courbevoie.

TPA2, Pontoise, France, 15,243 kc., daily 6-11 a.m., chimes every quarter hour (Welper); 15,210 kc. (Diez).

TPA3, Pontoise, France, 11,885 kc., daily 12:15-5 p.m. (Welper, Fleming); 11 p.m. (Wollenschlager, Unger, Dressler).

TPA4, Pontoise, France, 11,720 kc., daily 6:15-8:15 p.m. and 10 p.m.-1 a.m. (Welper); 11,710 kc. (Pierce, Dressler); 11,630 kc. (Diez); daily 7-12 p.m. (Fleming, Black).

HBO, Geneva, Switzerland, 11,402 kc., Saturday 7-8:45 p.m. (Alfred); 2 p.m. (Westman); daily except Saturday 2-2:15 p.m. (Shamleffer, Fleming, Partner, Sargent).

HBJ, Geneva, Switzerland, 14,535 kc., Saturday 7-8:45 p.m. (Alfred); 1 p.m. (Westman, Shamleffer); daily at 11 a.m. (Westman).

HB9D, Zurich, Switzerland, 9535 kc., schedule: Sunday 9-11 a.m., Thursday 1-3 p.m. (N. C. Smith, Margrie). Address: P. O. Box No. 2.

GSF, Daventry, England, 15,140 kc., daily 4-6 p.m. and 6:20-8:30 p.m. (Welper, Wollenschlager, Allison).

GSO, Daventry, England, 15,180 kc., daily 4-6 p.m. and 6:20-8:30 p.m. (Welper, Dressler).

GSH, Daventry, England, 21,470 kc., 8:45 a.m. on Sunday (Chadwick); daily 9:15-12 a.m. (Dressler).

GSP, Daventry, England, 15,310 kc. (Wollenschlager); daily 4-5:45 p.m. (Dressler, Diez);

Corner *the* WAVES

L. M. Cockaday

COSTA RICA'S NEW STATION

Observer Lee Meade Williams sends us in another "first" in the form of this verification of TILS.

daily 6:15-8:30 p.m. (Fleming).

GSG, Daventry, England, 17,790 kc., 5-6 p.m. (Patrick); daily 12:15-6 p.m., 9-11 p.m. (Welper, Wollenschlager, Oglesby, Diez, Partner, Dressler, Allison).

GSI, Daventry, England, 15,260 kc., daily 12:15-4 p.m., 9-11 p.m. (Welper, Wollenschlager, Diez, Partner, Dressler).

GSJ, Daventry, England, 21,530 kc., daily 9:15-12 a.m. (Dressler).

DJB, Zeesen, Germany, 15,200 kc., daily 4:50-10:45 p.m. (Alfred, Welper, Lander, Myers, Wollenschlager, Dressler, Coover, Fleming).

DJD, Zeesen, Germany, 11,770 kc., daily 4:50-10:45 p.m. (Alfred, Welper, Harley, Lander, Myers, Wollenschlager, Dressler, Coover, Fleming, Black).

DJL, Zeesen, Germany, 15,110 kc., daily 4:50-10:45 p.m. (Alfred, Welper, Wollenschlager, Nigh); daily 2-4:30 p.m. (Dressler, Allison).

DJQ, Zeesen, Germany, 15,280 kc., daily 4:50-10:45 p.m. (Alfred, Welper, Lander, Wollenschlager, Dressler); daily 6-12 a.m. (Fleming).

DJO, Zeesen, Germany, 11,790 kc., 8:15-8:45 p.m. (Harley); signed 7 p.m. (Welper).

DJR, Zeesen, Germany, 15,340 kc., 4:50-10:45 p.m. (Welper, Dressler).

DIP, Zeesen, Germany, 14,410 kc., 4:50-8:45 p.m. (Alfred).

DZG, Zeesen, Germany, 15,360 kc., signed 3:45 p.m. (Welper).

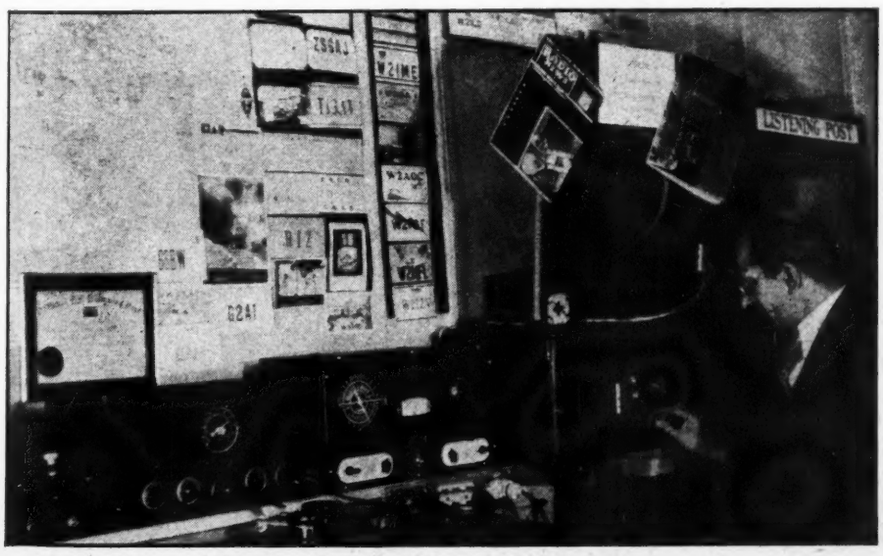
DZE, Zeesen, Germany, 12,130 kc., Wednesday 1-4 p.m. (Westman).

RAN, Moscow, U. S. S. R., 9595 kc., daily 7-9:15 p.m. and Monday, Friday and Saturday 4-5 p.m. (Alfred, Patrick, Black, Welper); 11:30-12 p.m. (Fleming, Myers, Partner, Wollenschlager, Unger, Dressler, Markuson).

RNE, Moscow, U. S. S. R., 12,000 kc., daily 7-9:15 p.m. and Monday, Friday and Saturday 4-5 p.m. (Alfred); Thursday 4-5 p.m.

IN LITTLE OLD N. Y.

Pictured below is Observer Herman Ruppert, of New York City, tuning in one of his numerous receivers in his DX corner. Notice the prized L.P.O. certificate framed on the wall.



(Myers, Shamleffer); daily 11 p.m.-2 a.m. (Fleming).

RKI, Moscow, U. S. S. R., 7500 kc., daily 7-9:15 p.m. and on 15,090 kc. (Alfred); 15,000 kc.—"This is Moscow Calling" (Welper); 7518 kc. (Partner, Dressler).

RAG, Moscow, U. S. S. R., 12,150 kc., irregularly 10:15-11:30 p.m. (Alfred).

CSW, Lisbon, Portugal, 9930 kc., daily 6-8 p.m. (Alfred); 11,040 kc., 12-4 p.m. (Partner); 9940 kc. (Dressler, Westman, Shamleffer, Markuson).

CT1AA, Lisbon, Portugal, 9650 kc., Tuesday, Thursday and Saturday 3:30-6 p.m. (Alfred, Welper, Unger); 11,830 kc. (Ruppert, Atherton, Westman, McKenzie, Fleming, Shamleffer). Slogan: "Radio Colonial," cuckoo call used. Address: Av. Antonio Augusto d'Aguiar, 144, Lisbon.

OLR4A, Prague (Podebrady), Czechoslovakia, 11,840 kc., daily 2:30-4:30 p.m., Thursday 8-10 p.m. (Alfred); 7:10-7:50 p.m. (Patrick, Welper); signs Sunday 5:15 p.m. (Fleming); Monday and Thursday 7-9:10 p.m. (Lander, Myers, Unger, Murray, Shamleffer).

OLR5A, Prague, Czechoslovakia, 15,230 kc., Thursday 8-10 p.m. (Alfred); daily 2-2:15 p.m. (Noyes, Welper); Monday 8-10:15 p.m. (from veri) (Markuson).

OLR3A, Prague, Czechoslovakia, 9550 kc., Thursday 8-10 p.m. (Alfred).

TFJ, Reykjavik, Iceland, 12,235 kc., Sundays only, 1:40-2:30 p.m. (Alfred, Myers, McKenzie, Fleming, Shamleffer).

(*Turn to page* 418)

WORLD SHORT WAVE TIME-TABLE

Compiled by LAURENCE M. COCKADAY

Hours of transmission for the World's Short Wave Broadcast Stations

8	9	10	11	M	1	2	3	4	5	6	7	FILL IN LOCAL TIME
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME

Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION
13.93	W8XK	21540	Pittsburgh, Pa.	D
13.93	GSJ	21530	Daventry, England	D D
13.94	W2XE	21520	New York, N. Y.	XS
13.97	GSH	21470	Daventry, England	D D D
15.77	HS8PJ	19020	Bangkok, Siam	M M
16.86	GSG	17750	Daventry, England	D D D D D D D D D D D D
16.87	W3XAL	17750	Bound Brook, N. J.	D D D D D D D D D D D D
16.88	PHI	17770	Huizen, Holland	D D R
16.89	W2XE	17760	New York, N. Y.	D D
16.89	DJE	17760	Zeesen, Germany	D D D S S
19.56	DJR	15340	Zeesen, Germany	D
19.57	W2XAD	15330	Schenectady, N. Y.	D D D D D D D D D D
19.60	GSP	15310	Daventry, England	D D D D
19.62	LRU	15290	Buenos Aires, Arg.	D
19.63	DJQ	15280	Zeesen, Germany	D D D S S D D D
19.65	W2XE	15270	New York, N. Y.	S S D XS D
19.66	GSI	15260	Daventry, England	D D D D
19.68	TPA2	15243	Pontoise, France	D D D
19.71	PCJ	15220	Huizen, Holland	W W W
19.72	W8XK	15210	Pittsburgh, Pa.	D D D D D D D D D D D D
19.74	DJB	15200	Zeesen, Germany	D D D S S D D D D
19.75	ZBW4	15190	Hong Kong, China	D D Sa
19.76	GSO	15180	Daventry, England	D D D D D
19.79	JZK	15160	Nazaki, Japan	D D D D
19.82	GSF	15140	Daventry, England	D D D D D
19.84	HVJ	15121	Vatican City	I
19.85	DJL	15110	Zeesen, Germany	D D D D D D D D D D
19.88	RKI	15090	Moscow, U.S.S.R.	D
20.04	LZA	14970	Sofia, Bulgaria	S S S U U S S
22.16	SPW	13653	Warsaw, Poland	C C C S S S
24.52	TFJ	12235	Reykjavik, Iceland	S S
25.00	RV59(RNE)	12000	Moscow, U.S.S.R.	S H
25.24	TPA3	11885	Pontoise, France	D D D D D D D
25.27	W8XK	11870	Pittsburgh, Pa.	D
25.34	OLR4A	11840	Podebrady, Czech.	D AM
25.36	W9XAA	11830	Chicago, Ill.	D D D D I I D D I
25.40	I2RO4	11810	Rome, Italy	D XS XS D D D D D D D XS XS
25.42	OER2	11800	Vienna, Austria	XS XS XS XS XS XS XS Sa Sa
25.42	JZJ	11800	Nazaki, Japan	D D D
25.45	W1XAL	11790	Boston, Mass.	Sa Sa Sa D D D
25.49	DJD	11770	Zeesen, Germany	D D D D D D D D D D D D
25.53	GSD	11750	Daventry, England	D D D D D D D D D D
25.58	CJRX	11730	Winnipeg, Canada	D D
25.60	TPA4	11720	Pontoise, France	D D
25.62	HJ4ABA	11710	Medellin, Colombia	D D I D D
25.63	SBG	11705	Motala, Sweden	D D D D D D D D D D D D D D
25.64	HP5A	11700	Panama, Pana.	D D D D D D D D D D D D
26.24	COCX	11435	Havana, Cuba	D D D D XS S S
26.60	HIN	11280	Trujillo, D. R.	XS
27.17	CSW	11040	Lisbon, Portugal	D D D D D D D D D D
28.93	EAJ43	10370	Tenerife, C. I.	D D I I
29.04	ORK	10330	Ruysselede, Belgium	D D
30.18	CSW	9940	Lisbon, Portugal	S S D D
30.43	EAQ	9860	Madrid, Spain	K
31.00	CQN	9677	Macao, Asia	D D D D D D D D D D D D D D
31.06	LRX	9660	Buenos Aires, Argentina	D D
31.09	YNLF	9650	Managua, Nicaragua	D D
31.09	CT1AA	9650	Lisbon, Portugal	G G G I
31.10	HH3W	9645	Port-au-Prince, Haiti	D D D D D D XS XS XS XS
31.14	I2RO	9635	Rome, Italy	D D D D
31.25	RAN	9600	Moscow, U.S.S.R.	D D D D D D D D D D
31.25	HJ1ABP	9600	Cartagena, Colombia	D D D Sa Sa
31.27	HBL	9595	Geneva, Switzerland	D D D D D D D D D I
31.28	VK6ME	9590	Perth, Australia	S S S S AM D
31.28	W3XAU	9590	Philadelphia, Pa.	S S D S D
31.28	VK2ME	9590	Sydney, Australia	XS D
31.28	PCJ	9590	Huizen, Holland	D D D D D D D D D D D D D D
31.28	HP5J	9590	Panama City, Pana.	D D D D D D D D D D D D D D
31.32	GSC	9580	Daventry, England	D D D D D D D D D D D D D D
31.32	VK3LR	9580	Lyndhurst, Australia	D D D D D D D D D D D D D D
31.33	HJ2ABC	9575	Cucuta, Colombia	D D D D D D D D D D D D D D
31.35	W1XK	9570	Millis, Mass.	D D D D D D D D D D D D D D
31.38	DJA	9560	Zeesen, Germany	D D D D D D D D D D D D D D
31.40	TIPG	9559	San Jose, C. R.	D D D D D D D D D D D D D D
31.42	OLR3A	9550	Podebrady, Czech.	D D D D D D D D D D D D D D
31.42	XEFT	9550	Veracruz, Mexico	D D D D D D D D D D D D D D
31.45	DJN	9540	Zeesen, Germany	D D D D D D D D D D D D D D
31.48	W2XAF	9530	Schenectady, N. Y.	D D D D D D D D D D D D D D
31.48	LKJ1	9530	Jeloy, Norway	D D D D D D D D D D D D D D
31.49	ZBW3	9525	Hong Kong, China	D D Sa
31.51	OAX4J	9520	Lima, Peru	D D D D D D D D D D D D D D
31.55	GSB	9510	Daventry, England	D D D D D D D D D D D D D D
31.55	HJU	9510	Buenaventura, Colom.	C C
31.55	VK3ME	9510	Melbourne, Australia	D D D D D D D D D D D D D D
31.58	PRF5	9500	Rio de Janeiro, Brazil	D D XS XS
31.68	HJ1ABE	9500	Cartagena, Colombia	D X X S S S D XS XS
31.82	COCH	9428	Havana, Cuba	D D D D D D D D D D D D D D
32.09	HS8PJ	9350	Bangkok, Siam	Th Th
32.88	HAT4	9125	Budapest, Hungary	S D
33.32	COBZ	9030	Havana, Cuba	D D D D D D D D D D D D D D
34.62	COJK	8665	Camaguey, Cuba	D D D D D D
38.48	HBP	7797	Geneva, Switzerland	Sa Sa
43.48	HI3C	6900	La Romana, D. R.	D D D
43.52	XGOX	6820	Nanking, China	D D XS

WORLD SHORT WAVE TIME-TABLE

(Continued from the Previous Page)

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME															
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME				8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME				13	14	15	16	17	18	19	20	21	22	23	00
HOURS OF TRANSMISSION												Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION											
AC							D					44.14	HIH	6796	San Pedro, D. R.					AC	AC			S			AC
D	D	I	I									44.71	TIEP	6710	San Jose, Costa Rica										I	D	D
	T	T	T									45.22	HC2RL	6635	Guayaquil, Ecuador										S	S	S
			Sa	Sa								45.25	HIT	6630	Trujillo, D. R.					XS	XS					D	D
	Th	Th	Th									45.34	PRADO	6618	Riobamba, Ecuador		T	T									
												45.80	HI4D	6550	Trujillo, D. R.				XS	XS	XS			XS	XS	XS	XS
D	D											46.01	YV4RA	6520	Valencia, Venezuela				D	D	D				D	D	D
D	I											46.08	HIL	6510	Trujillo, D. R.											D	D
												46.66	HI1S	6430	Puerto Plata, D. R.					D	D					D	D
D	D	D	I	I	I							46.85	YV5RH	6400	Caracas, Venezuela										D	D	D
												46.91	HI8Q	6395	Trujillo, D. R.				D	D	D				D	D	D
D	D	D									D	47.10	YV5RF	6375	Caracas, Venezuela				D	D	D				D	D	D
D	D	D	D									47.12	YV1RH	6360	Maracaibo, Venezuela												D
D	D										D	47.24	HRP1	6350	San Pedro Sula, Honduras					D	D					D	D
I	I	Sa	Sa									47.54	HIZ	6310	Trujillo, D. R.					S	S	S		I	I	I	I
I	I	I										47.62	YV4RD	6300	Maracay, Venezuela												
XS	XS											47.77	HIG	6280	Trujillo, D. R.												XS
	D	D										47.77	COHB	6280	Sancti Spiritus, Cuba		D			D				D	D		
D	D											48.05	HIN	6243	Trujillo, D. R.					D	D						D
XS	XS	XS										48.11	HRD	6235	La Ceiba, Honduras									S	S		
L	L	L										48.15	OAX4G	6230	Lima, Peru												L
AM												48.19	HJ1ABH	6225	Cienaga, Colombia												AM
D	XS	XS		S								48.39	COKG	6200	Santiago, Cuba										D		
D	D	I	I	I								48.50	HI1A	6185	Santiago, D. R.				D	D	D						D
D	D	D		D								48.62	OAX1A	6170	Chiclayo, Peru												
D	D	D										48.70	XEXA	6160	Mexico, D. F. Mexico												D
										XS	XS	48.70	VPB	6160	Colombo, Ceylon	XS	XC	V	V	Sa							
D	D	D	D									48.70	CJRO	6160	Winnipeg, Canada											D	D
D	D	D										48.72	YV5RD	6158	Caracas, Venezuela				D	D	D			D	D	D	D
			Sa	Sa								48.78	VE9CL	6150	Winnipeg, Canada												
D	D											48.78	HJ2ABA	6150	Tunja, Colombia						D						D
	D	D	D									48.78	HJ5ABC	6150	Cali, Colombia				D	S	S						
		D	D	D								48.86	W8XK	6140	Pittsburgh, Pa.												
								D	D	D		48.88	CR7AA	6137	Lourenzo Marques, A.					D	D	D	D				
												48.94	LKJ1	6130	Jelov, Norway				D	D	D	D	D	D			
D	D	D									X	48.94	VE9HX	6130	Halifax, N. S.	X	X	X	X	X	F	F	SF	D	D	D	D
D	D	D	D	D	D							48.94	COCD	6130	Havana, Cuba												D
D	D	D	XS									48.96	HJ3ABX	6122	Bogota, Colombia			XS	XS	D	D				XS	D	D
D	D	D										49.00	HJ1ABB	6120	Barranquilla, Colom.				D	D					D	D	D
					D	D		S	S	S	D	49.18	YTC	6100	Belgrade, Yugoslavia	XS					D	D	D	D	D		
	D	D	D	D								49.18	W3XAL	6100	Bound Brook, N. J.												
			XSa	XS								49.18	W9XF	6100	Chicago, Ill.												
D			XS	XS			XS	D	XS	XS	S	49.20	ZTJ (JB)	6098	Johannesburg, Africa	S	D	D	XS	D	D	D	D				
D	D	D	D									49.20	HJ4ABE	6097	Medellin, Colombia		D	D	D	D					D	D	D
			Sa									49.26	CRCX	6090	Toronto, Canada				S	D	D	D	D	D	D	D	D
XS	XS	XS										49.30	HJ5ABD	6085	Cali, Colombia												N
XS	XS	D										49.31	HJ3ABF	6084	Bogota, Colombia				D								XS
									X	X		49.32	VQ7LO	6083	Nairobi, Kenya, Afr.	E	E		U	U	U	XC			XS	XS	
D	D	XS	XS									49.34	HP5F	6080	Colon, Panama					S	D	XS		S	S		D
D	D	D	D							D	D	49.34	W9XAA	6080	Chicago, Ill.	D	D	D	D	D	D	D	D	D	D	D	D
											XS	49.34	ZHJ	6080	Penang, S. S.	XS											
D	D											49.42	YV1RE	6070	Maracaibo, Venez.				D	D					D	D	D
D	D											49.46	SBG	6065	Motala, Sweden											D	D
			D	D	D					XS	XS	49.50	W8XAL	6060	Cincinnati, Ohio	D	D	D	D	D	D	D	D	D	D	D	D
D	D	I										49.50	W3XAU	6060	Philadelphia, Pa.												
												49.59	HJ3ABD	6050	Bogota, Colombia					D						D	D
D	D	D										49.59	HI9B	6050	Trujillo, D. R.					D						D	D
	D											49.63	HJ3ABI	6045	Bogota, Colombia												
XS	XS	XS		Sa								49.65	HJ1ABG	6042	Barranquilla, Colom.					XS	XS	S				XS	XS
D												49.67	W1XAL	6040	Boston, Mass.												D
							D	D	D	D		49.67	YDA	6040	Tandjong Priok, Java												
D	D	D										49.75	HP5B	6030	Panama City, Panama					D				I			D
D	D	D	D		I							49.79	HJ1ABJ	6025	Santa Marta, Colombia					D							D
D	D	D										49.83	DJC	6020	Zeesen, Germany			D	D	D	D	D	D	D	D	D	D
D	D	D	D	D								49.83	XEUW	6020	Veracruz, Mexico	D	D	D	D	D	D	D	D	D	D	D	D
E	XS	XS	XS									49.88	XEWI	6015	Mexico, D. F., Mexico								C		I		E
D	D	D	I									49.90	HJ3ABH	6012	Bogota, Colombia				D	D	D	D		S	S	D	D
			Sa	Sa								49.92	COCO	6010	Havana, Cuba		D	D	D	D				D	D	D	
												49.96	CFCX	6005	Montreal, Canada	D	D	D	D	D	D				Sa		
D											D	49.96	HP5K	6005	Colon, Panama	D				D						D	D
D	D	D	D	D								50.00	XEBT	6000	Mexico, D. F., Mexico			D	D	D	D	D	D	D	D	D	D
Z	Z	Z									S	50.17	HIX	5980	Trujillo, D. R.	S	S	S		D	D			D	D		
D	D	D										50.25	HJN	5970	Bogota, Colombia				D								
									S			50.26	HVJ	5969	Vatican City							D					
XSa	D	Sa	Sa									50.50	TG2X	5940	Guatemala City, Gua.												
XS	XS											50.72	HH2S	5915	Port-au-Prince, Haiti						D						
D	D	S	S									50.76	HRN	5910	Tegucigalpa, Honduras					D		S	S	S	D	D	D
D	D											50.85	YV3RA	5900	Barquisimeto, Venez.					D						D	D
D	D											51.15	HI1J	5865	San Pedro, D. R.					D	D	D				D	D
D	D											51.46	TIGPH	5830	Alma Tica, Costa Rica					D	D					D	D
D	D	D										51.72	YV5RC	5800	Caracas, Venezuela	XS	S	S	D	D	D	D	S	D	D	D	D
	AH	AH	AH									51.90	OAX4D	5780	Lima, Peru.		AN	AN	AN								

List of Symbols

A—Tuesday, Wednesday, Thursday
B—Saturday, Sunday
C—Monday, Wednesday, Friday
D—Daily
E—Tuesday, Thursday
F—Friday
H—Sunday, Monday, Wednesday, Friday
G—Tuesday, Thursday, Saturday
I—Irregularly
J—Sunday, Tuesday, Wednesday
K—Monday, Friday
L—Wednesday, Saturday
M—Monday
N—Tuesday, Wednesday
P—Except Tuesday, Wednesday
Q—Sunday, Monday, Tuesday
R—Sunday, Wednesday, Saturday
S—Sunday
SF—Sunday, Friday
T—Tuesday
Th—Thursday
U—Sunday, Monday, Thursday
V—Sunday, Wednesday
W—Wednesday
Z—Tuesday, Friday
AC—Monday, Thursday, Saturday
AG—Tuesday, Sunday
AH—Monday, Wednesday, Saturday
AM—Monday, Thursday
AN—Tuesday, Saturday
AO—Wednesday, Thursday
Sa—Saturday
X—Except Saturday, Sunday
XC—Except Tuesday, Thursday, Sunday
XS—Except Sunday
XSa—Except Saturday

OUR POLISH OBSERVER

Mr. M. P. Piorko poses for a picture in Poland. Plenty of P's in this caption, but then again Observer Piorko watches his P's and Q's when sending in his very accurate short wave reports.

The DX Corner
(Short Waves)

(*Continued from page* 415)

PCJ, Huizen, Holland, 9590 kc., Sunday 7-9:10 p.m., Wednesday 7-10 p.m. (Alfred); Tuesday 1:30-3 p.m. (Welper, Wollenschlager, Pierce); 15,220 kc. (Dressler, Unger); Tuesday 4:30-6 a.m., 15,220 kc. (Shamleffer); Sunday 2-3 p.m. (Markuson, Gallagher, Coover, Fleming, Black, Shamleffer).

PHI, Huizen, Holland, 11,730 kc., 9-12 p.m. (Gallagher, Coover, Fleming, Dressler); 11,740 kc. (Shamleffer).

HAT4, Budapest, Hungary, 9125 kc., Wednesday and Sunday 7-8 p.m. (Alfred); 6 p.m. (Nigh, Unger, Dressler, Cindel, Fleming, Shamleffer).

HAS3, Budapest, Hungary, 15,370 kc., Sunday 11-12 a.m. (Smith); Sunday, 9-10 a.m. (Unger).

LKJ1, Jeloy, Norway, 9520 kc., daily 5:15-8 a.m. and 11 a.m.-5 p.m. (from veri) (Smith, Ruppert).

SM5SX, Stockholm, Sweden, 15,155 kc., irregularly (Smith, Millen); daily 11 a.m.-5 p.m. or later (Partner); on all day Sunday (Wilson).

SBO, Stockholm, Sweden, changed from SBG, 3 p.m. (McKenzie, Birnie).

LZA, Sofia, Bulgaria, 14,940 kc., daily from 4 p.m. (Betances, Scala). Address: Maskovska, Rue 19, Sofia.

OZF, Skamlebaek, Denmark, 9520 kc., replaces OXY (N. C. Smith); 2-4 p.m. (Beard, Eder); 4-7 p.m. (Partner).

OER2, Vienna, Austria, 11,800 kc., Monday and Friday 10 a.m.-5 p.m. and Saturday 10 a.m.-6 p.m. (Ruppert).

SPW, Warsaw, Poland, 13,635 kc., Sunday 11:30 a.m.-1:30 p.m. (Partner); Sunday 6-8 p.m. and week days 6-7 p.m. (McKenzie).

I2RO3, Rome, Italy, 9635 kc., 6 p.m. (Welper); Thursday and Saturday 6-7:45 p.m. (Cindel).

Africa

EAJ43, Tenerife, Canary Islands, 10,370 kc., daily 2-4 p.m., 4-6 p.m., 7:20-7:55 p.m., 8-9:45 p.m. (Neuerbourg); relays EA8AB (Westman, Alfred, Fleming, Shamleffer). Address: P. O. Box No. 225.

EA9AH, Tetuan, Spanish Morocco, 14,030 kc., 4:45-5:30 p.m. (Smith); daily 7-9 p.m., works amateurs after 9 p.m. (Alfred, Fleming); 5-6 p.m. (N. C. Smith); 14,004 kc. (Shamleffer, Diez).

VQ7LO, Nairobi, Kenya Colony, Africa, 6082 kc. (Millen); Saturday 8:15 p.m. (N. C. Smith).

CR7BH, Lourenzo Marques, Mozambique, 11,718 kc., daily 10:30 a.m.-12:30 p.m. (Pierce).

ZTJ, Johannesburg, Transvaal Protectorate, South Africa, 9650 kc., schedule: Monday, Thursday and Friday 11:45 p.m.-12:30 a.m., 3-7 a.m., 9 a.m.-4 p.m., Saturday the same except last time is 8:15 a.m.-4:45 p.m., Sunday 4-4:45 a.m., 8 a.m.-3:15 p.m. (Van Os); bugle calls used, 9620 kc. (announced frequency is 9650 kc.), reports requested, announce in English (Gallagher); 6097 kc. (Markuson). Address: P. O. Box No. 4559.

ZNB, Mofeking, South Africa, 5900 kc., Monday through Friday 1:15-2 a.m., 1-9:30 p.m., Sunday 1-2:30 p.m. (Wilson). Address: Bechuanalanel Protectorate, So. Africa.

Oceania

VK6ME, Perth, Australia, 9590 kc., daily 6-7:30 p.m. (Alfred); daily except Sunday 5-8 a.m. (Fleming, Gertenbach). Address: c/o Amalgamated Wireless Ltd.

VK3ME, Melbourne, Australia, 9510 kc., signs daily except Sunday at 7 a.m. (Noyes, Welper); 9500 kc., daily 6-7:30 a.m. (Alfred); daily 4-7 a.m. (Myers, Lindner, Fleming, Dressler).

KZRM, Manila, Philippine Islands, 11,840 kc. (Millen); 9570 kc., 1:30-2 a.m. daily (Pierce).

VPD2, Suva, Fiji Islands, 9540 kc., signs daily at 7 a.m. (Noyes, Welper); daily 6-7 a.m. (Alfred, Lander); 15,165 kc. (Partner).

WHERE IS "TOLPIN"?

Observer Samuel Tolpin is missing! Letters addressed to him have never been answered. Does any one know if he has moved and if so where to? The photo at the right was taken of his DX corner in 1935.

Asia

JZK, Nazaki, Japan, 15,160 kc., daily 3-4 p.m., 4:30-5:30 p.m., signed with music and gong, Sunday 9:30-10 a.m. (Welper); 12:30-1 a.m. and 8-9 a.m. (Alfred); daily 12:30-1 a.m. (Smith, Chadwick, Markuson, Wollenschlager, Neuerbourg, Mott, Shamleffer, Black).

JZJ, Nazaki, Japan, 11,800 kc., daily 8-9 a.m., 3-4 p.m. and 4:30-5:30 p.m. (Welper, Alfred); daily 12:30-1:30 a.m. (Smith, Chadwick, Myers, Neuerbourg, Pierce, Lindner, Fleming). Slogan: "The Voice of Tokio."

JVN, Nazaki, Japan, 10,660 kc., daily 3-7:30 a.m. (Welper); 4:30-5:30 p.m. (Alfred, Watson, Pierce, Diez, Dressler).

JVO, Nazaki, Japan, 10,370 kc., Thursday 7-8 a.m. (Myers).

JFAK, Taiksku, Japan, 9600 kc., 8:30 a.m. (Eder).

JIB, Taiwan, 10,530 kc., daily 2:10-3:15 a.m. (Pierce); signed 7:40 a.m. (Lindner, Gallagher).

PLP, Bandoeng, Java, 11,000 kc., daily 5-10 a.m. (Welper, Alfred, Pierce, Gallagher, Fleming, Black).

PLY, Bandoeng, Java, 9415 kc., 6-7:30 a.m. (Alfred, Gallagher, Black).

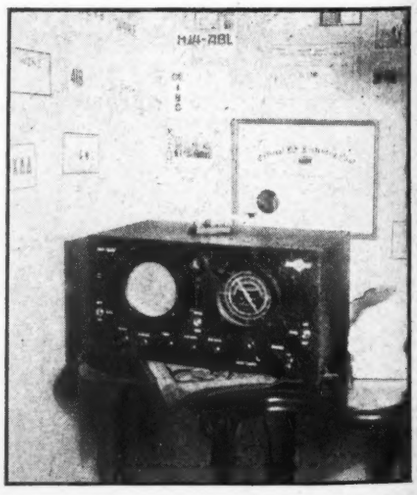
YDB, Soerabaja, Java, 9550 kc., daily 6-10 a.m. (Fleming, Gallagher); daily 6-7:30 p.m. (Markuson).

HS8PJ, Bangkok, Siam, 19,020 kc., Thursday 8-10 a.m. (Westman); Monday 8-10 a.m., 19,020 kc., and Thursday 8-10 a.m., 9510 kc. (Partner, Sakely, Pierce, Pairman, Gallagher, Black).

ZBW3, Hong Kong, China, 9610 kc. (Lander, Diez); 9525 kc., daily 5-9 a.m. (Fleming).

XGOX, Nanking, China, 9800 kc., daily 12-3 a.m. (Pierce, Gallagher).

(*Turn to page* 442)



The A, B, C's of ANTENNAS *(Impedance Matching)*

By I. Queen

Part Two

IN the last installment, the author explained how antennas operate. This month, he starts an explanation of the all-important factor of "matching" to obtain maximum efficiency from the antenna.

THE impedance of an antenna or any circuit can be considered its a.c. resistance. It is the ratio of the effective a.c. voltage to the effective alternating current. It depends upon the resistance and the reactance present in the circuit. For instance, at the ends of a Hertz antenna we have points of high impedance, for the ratio of its voltage to its current is almost infinite. Likewise, at the center of a half-wave Hertz we have a point of very low impedance because of the low ratio of voltage to current.

Matching Impedance

It is well-known that in a d.c. circuit, power is most efficiently transferred from a source to a load when the resistance of the load equals that of the source. This principle of "impedance matching" appears often and should be well understood. For those acquainted with the elements of differential calculus we have the following proof of this principle. In Figure 1, R_L is the resistance of the load, R_B the resistance of the source, and E the applied voltage. W is the power in the load.

$$I = \frac{E}{R_B + R_L} \qquad W = \frac{E^2 R_L}{(R_B + R_L)^2}$$

$$\frac{d\,W}{d\,R_L} =$$

$$\frac{E^2(R_B + R_L)^2 - (E^2 R_L)\,(2)\,(R_B + R_L)}{(R_B + R_L)^4}$$

$$= \frac{E^2\,(R_B - R_L)}{(R_B + R_L)^3}$$

When the differential coefficient of W with respect to R_L is zero, we have a maximum in the variation of output power with respect to R_L. This happens when the numerator of the last equation becomes zero: $E^2 (R_B - R_L = 0$ or $R_B - R_L = 0$ and $R_B = R_L$

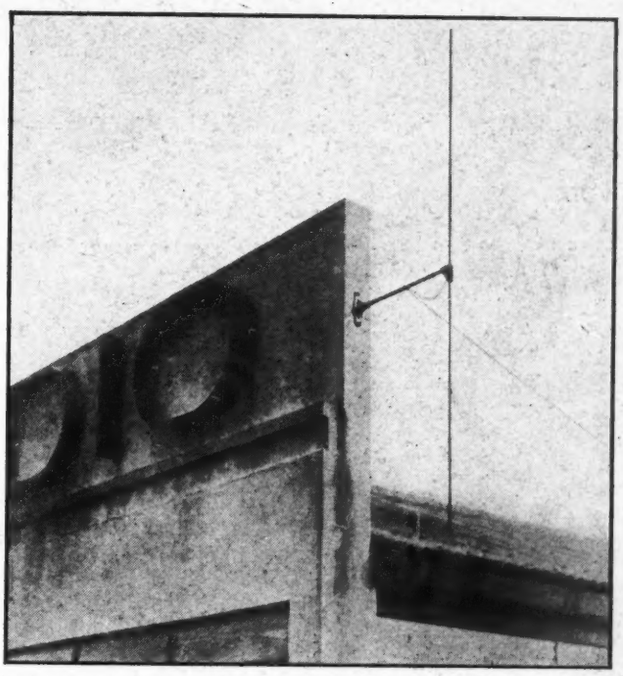
The resistance of the load should equal the resistance of the source for maximum transfer of energy.

For those who cannot follow the above reasoning, we have these considerations. Let us take the case of an automobile climbing up a hill. The car can always produce a certain amount of power. On a horizontal surface we would seldom use low gear. More power can be obtained by using high gear. In climbing the hill, however, we are forced to use low gear to accomplish maximum results. We simply "match impedances" in both cases. We can either have great speed and low lifting force or low speed and great lifting force. We cannot have both because the energy available is assumed constant.

Familiar Analogy

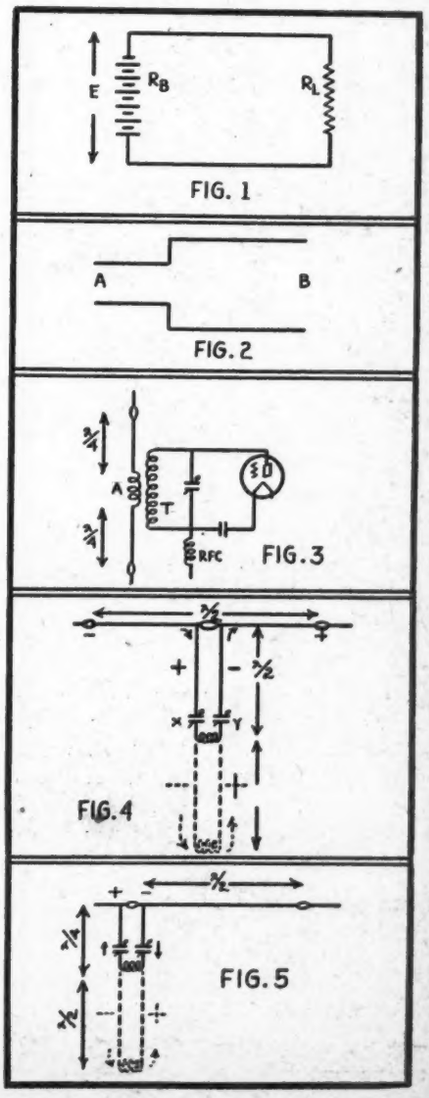
Let us examine Figure 2. Here we have a channel A filled with water opening suddenly into another channel B. If we start a wave in A we will find that on reaching the channel B it will become of much smaller amplitude and another wave is started back or reflected. Likewise, if a wave were started in B, it would travel into A but at the junction a reflection would again take place, and it would be impossible to obtain a maximum wave. Only when the two channels are of equal width or "impedance" will the wave travel on without reflection, so that more energy will be transferred from source to load.

In the same way, electrical energy has two components; voltage and current. A source of power might have available a (*Turn to page* 440)



SOON TO BE SEEN ON EVERY HOUSETOP?

This is the Belling-Lee Antenna now in wide use in England for reception for pictures. Radio dealers, servicemen, amateurs, and experimenters should learn something about installation of such equipment to be ready when television starts commercially in the U. S. A.



RADIO NEWS INDEX

Reading the 'want-ads' in the hope of finding just any sort of a job—

TAKE YOUR CHOICE

Glamour and romance in Television-Broadcasting! An action scene "on stage" in the Power and Light Building, the home of Midland Television and the base of Midland's training.

A Lifetime of Fear for the FUTURE ? —OR— A GOOD JOB, MORE MONEY, A BRILLIANT FUTURE *in*—

TELEVISION

YOU CAN BE ONE OF THE VERY FIRST TO BE TRAINED ON "ULTRA-MODERN," 441-LINE ELECTRONIC TELEVISION EQUIPMENT

BROADCASTING—
AIRLINE OPERATING
SHIP OPERATING
POLICE RADIO

Sound advice. Based on ironclad facts! If that's what you want, read on. But if you're looking for the easy, "gambling way" of winning success, you might as well stop reading right now.

This very minute you're confronted with opportunities of such magnitude that you may be inclined to doubt their existence...Yet you know how Radio skyrocketed into a giant industry almost overnight. You know that many young men have won, and are continuing to win, success in Radio—BECAUSE THEY TRAINED THEMSELVES FOR SUCCESS...And now we all know that TELEVISION will be another world-wide industry, rich in rewards for those who are prepared...WILL YOU BE READY?...Yes, if you take immediate advantage of the outstanding features of Midland training!

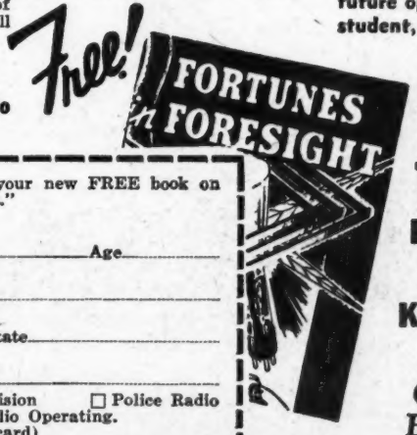
Midland is the ONLY independent school offering complete, ultra-modern training on 441-line RCA electronic television receiving and transmitting equipment. And *that* is the type of equipment that is bringing commercial television closer every day. Already perfected to a point comparable to motion pictures, "electronic scanning" is almost ready to do its part in starting America on another era of prosperity.

Midland training includes actual experience as a Television Camera Man!

To take advantage of Midland's outstanding training, you don't have to give up your present job. You complete your preliminary training *at home*—studying intensely interesting "color-coded" lessons, conducting a host of fascinating and instructive experiments, with *equipment we provide*—and then you come to Kansas City and our beautiful home in the Power & Light Building for *actual experience*. For remember, this is NOT a correspondence course. It is a combined extension-resident training. You study actual operation of radio and television in our resident school, in our modern laboratories—under an engineering staff of accomplished, friendly men, with years of practical experience.

If you are sincere in desiring to enter an industry that offers immediate, substantial cash rewards and a brilliant future, we invite you to send for your FREE copy of "Fortunes in Foresight." Just fill out, clip, and mail us the coupon below. DO IT TODAY AND WE WILL DO THE REST.

Full Transportation Allowance to Kansas City



"... It was you who pointed out the vast possibilities of a radio career for me. It was Midland that made it possible."

Orwin Middleton, employed by Earl J. Goetze, Inc., wholesale distributors RCA-Victor products.

"... Thank you for obtaining my new position. Even though only part way through my course of study with Midland, I have already received much value for the money and time invested."

Donald Welborn, employed by Radiolab, radio and public address sales, Kansas City, Mo.

"... and I want to tell you and the whole wide world that I owe it all to your incomparable training and wholehearted help!"

Wm. Davis, Radio Operator with TWA, stationed at Amarillo, Texas.

Midland training prepares for TWO Government radio operator's license exams; qualifies for immediate employment in radio, and the marvelous future opportunities in television. As a Midland student, everything will be in your favor.

Gentlemen: Without obligating me, please send me your new FREE book on Radio-Television opportunities, "Fortunes in Foresight."

Name_____ Age_____

St. or R. F. D._____

City_____ State_____

Occupation_____

I am most interested in ☐ Broadcasting ☐ Television ☐ Police Radio ☐ Ship Radio Operating ☐ Airline Radio Operating.

(Mail in envelope or paste on postcard)

MIDLAND TELEVISION, INC.

Power and Light Building,
110-A West 14th Street,
KANSAS CITY, MISSOURI

Affiliated with Columbia Network Basic Broadcast Station KMBC

SERVICE — SALES

(*Continued from page* 401)

one prong grounded to the chassis. I spotted the condenser okay, but the resistance was 12 ohms rather than zero. Measured directly across the condenser terminals the resistance was zero as it should be. This had me puzzled for a few minutes. As is common practice, resistors and condensers were grounded to bolts coming through the chassis—usually those which also hold the sockets in place. Upon measuring the resistance from these nuts or bolts to chassis, perceptible resistances were discovered—in one instance as high as 15 ohms. What had happened is obvious. In the course of time oxidation between the nuts, bolts and chassis increased the contact resistance. This increase of course would be negligible in the case of grounding a resistor (except for the possible introduction of noise). However, in the case of a condenser, the effect is to increase the power factor, and where this condition exists on several condensers in one set, the effect may be accumulative. I have improved the reception noticeably on several receivers through the simple expedient of eliminating this resistance. It is merely necessary to tighten the bolts. Even if already tight, the slight motion will be sufficient to break down the film."—R. B., Scotia, N. Y.

Belmont 540—A.C.-D.C.

This receiver is also sold by the Goodyear Service Stations under the name of "Wings."

Howard J. Surbey of North Canton, Ohio, sends us a nice example of servicing with an oscilloscope. He writes: "This receiver was inoperative except on local stations. An attempt was made to secure a resonance curve on the oscilloscope by connecting the vertical plates to chassis and grid of the type 75 tube, and coupling a frequency modulated oscillator to the antenna circuit in the manner used for aligning. With the receiver volume on full and all gain controls on the oscilloscope also full on, the oscillogram shown in Figure 4 was obtained at the 1000-kilocycle setting of the dial. Various tests were made with the instruments operating in the above manner in an effort to increase the amplitude of this tracing. When the 25 mfd. condenser (C13 in the Belmont diagram) connected from the cathode of the 25Z5 tube to choke was shunted with a good condenser, the oscilloscope curve increased to such an extent that it exceeded the screen. After reducing the gain controls, the oscillogram shown in Figure 5 was observed, and the receiver then operated in a fairly normal manner. The receiver was then aligned as outlined in the service manual, and the final overall resonance curve at 1000 kc is shown in Figure 6. The equipment used was a Triumph oscilloscope with a 3-inch tube and a Triumph wobbulator."

Stanley R. Covington — "Radio Service, Repairs, Parts, Supplies, Public Address Rentals—of Lynchburg, Va., sends us the following notes from his radio case book:

Bosch

"United American Bosch, Model 502: Plays choo choo—whistles for every station. A shield plate soldered to the chassis and interposed between the 75 and 43 tubes was the remedy after everything else had been checked and found okay.

Silvertone

"Chassis model 1954X. It squealed all over the dial. Only locals could be received, and at a moderate volume-control setting. All condensers checked perfect. The trouble was found to be a high resistance between the chassis and the tube shield bases —especially at the detector socket. The remedy is to solder the bases to the chassis.

Majestic No. 70

"The field coil in the type G2 speaker burned out. The customer wanted the set now or sooner, and the proper coil was not available. A Victor R-32, 3000-ohms field coil served by employing only one cardboard washer at each end. The air gap between the coil and the core may be filled in with iron washers of the right size—but a satisfactory job can be had without them."

Arvin Home Radios

Oscillation and other effects caused by ineffective grounding of shield cans are prevalent sources of radio troubles today—as will be appreciated by the many relevant contributions to this department. E. Scribner of Schoharie, N. Y. sends in the latest: "The Arvin home radios have lugs on the shield cans that fit through the chassis for grounding. Make sure that the shields are in place—lugs through the chassis holes —and that everything is tight."

Zenith Going in for Television?

Chicago, Ill.—It is reported that profits for the Zenith Radio Corp. during August exceeded all company records for the month. A special meeting of stockholders, which was held on October 26th, was called in order to vote on charter amendments so as to include activities in television and facsimile apparatus.

Lessons in Television

(*Continued from page* 396)

heat. One watt can, therefore, produce only from 8 to 12 lumens of light. If a standard candle lamp is placed in the center of a sphere with a radius of 1 ft. (diameter 2 ft.), the light will produce 4π or 12.57 lumens on the inner surface of the sphere or I lumen every square foot of inside surface area—there being 12.57 sq. ft. in all. Since this would light 1 sq. ft. of surface at 1 ft. distance, it might be called a foot-candle (which is I lumen) the most common unit of light intensity measurement. Since the total light value is the product of the light source intensity, and the area on which it falls, we see immediately that for a small area the light density must be increased to preserve the same total or product.

Coming back to Figure 8, we have an audio amplifier which may be tuned as desired to 2400 cycles. A band-pass filter is used to cut off all frequencies below 1200 cycles and above 2600 cycles.

Here for the first time, we can see the necessity of the vibrating light modulator. It permits the amplification of a definite audio frequency whereas if we attempted to amplify only the wave produced by the graduations in tone of the picture the amplifier would not be as effective at some points on the picture as others. For example, if the tone of the picture changed only gradually from light to dark or vice-versa, each grid in the amplifying system would change just as gradually and the corresponding frequency would not be sufficient to pass through the coupling condensers. The 2400 cycle tone, however, will be amplified the same amount throughout the system and the system will handle this energy with any rate of modulation desired. Just as we found it necessary to use a high-frequency carrier to transmit voice currents through space, we may use a "carrier" (2400 cycles) to transmit what we will call the "picture component" through a wire and amplifier circuit.

For Stronger Signals

Rochester, N. Y.—Mr. E. A. Hanover, Vice-President of the Stromberg-Carlson Telephone Mfg. Company, recently announced that station WHAM, NBC Blue Network affiliate, has under construction a self-supporting vertical antenna that will tower 450 feet into the air. The vertical radiator will be a 4-sided steel angle structure 25 feet at the base and tapering to a square 21 inches on a side.

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 69. Meters

USE of ammeters: From the foregoing chapter it is evident that a d. c. ammeter really consists of a portable type of D'Arsonval galvanometer with a suitable shunt connected across it, and a scale calibrated in amperes. The fine wire on the movable coil only carries a definite small fraction of the total current, which is being measured.

Ammeters are used in all branches of electrical work and are designed to measure small currents of a few thousandths of an ampere (milliampere) as well as currents of thousands of amperes. In radio work, low reading ammeters are commonly used to measure the currents in the filament circuits of the vacuum tubes. Ammeters used to measure the plate currents of these tubes are called *milliammeters* (one milliampere equals 1/1000 ampere), because their scales are marked to read the current in milli-amperes. The only difference between a d-c ammeter and d-c milliammeter is in the size of the shunt employed.

The ammeter or milliammeter must *always* be connected in *series* with *either* side of the line, as shown at (A) of Figure 1. When connecting an ammeter in a circuit, it is necessary to open one side of the line and connect the ammeter so the current flows *through* it. The instrument should have a range sufficiently high to carry the current flowing. Remember that the ammeter must always be connected in *SERIES* with *one side* of the line. Never connect an ammeter *across* the line, for since it has a very low resistance, the e.m.f. across the line would send a heavy rush of current through it and burn it out.

It is often desired to increase the range of a d.c. ammeter or milliammeter on hand, in order to save the cost of a new instrument of larger range. This may be done by connecting an additional shunt resistor across the terminals of the meter to shunt a portion of the total current around it. Thus consider in (A) of Figure 1, that the meter on hand (whether it already has a self-contained shunt in it or not does not make any difference) has a range of 0-1 milliamperes. Suppose we want to extend its range to 10 m.a. Then a shunt R_s must be connected across it such that the moving coil of the *meter* will carry 1/10 of the total current and the *shunt* 9/10, or the shunt resistance will be 1/9 of the meter resistance. If the meter resistance is 27 ohms for instance, the shunt resistance required to make a 0-10 milliammeter of it would be, $1/9 \times 27 = 3$ ohms.

In general let us suppose the meter considered has a resistance of R_m ohms and let R_s be the resistance of the additional shunt to be connected across it to increase its range. Let I_m be the original maximum scale reading (in amperes or milliamperes) of the instrument. Let I, be the desired new maximum reading (correspondingly in amperes or milliamperes). Then:

$$\frac{I}{I_m} = N = \text{multiplying factor.}$$

$$\text{and } R_s = \frac{R_m}{N-1}$$

Example: A milliammeter having a range from 0-50 milliamperes and an internal resistance of 2 ohms, is to be converted into an ammeter having a maximum range of 10 amperes. What value of shunt resistor must be connected across its terminals?

Solution: 10 amperes=10,000 milliamperes.

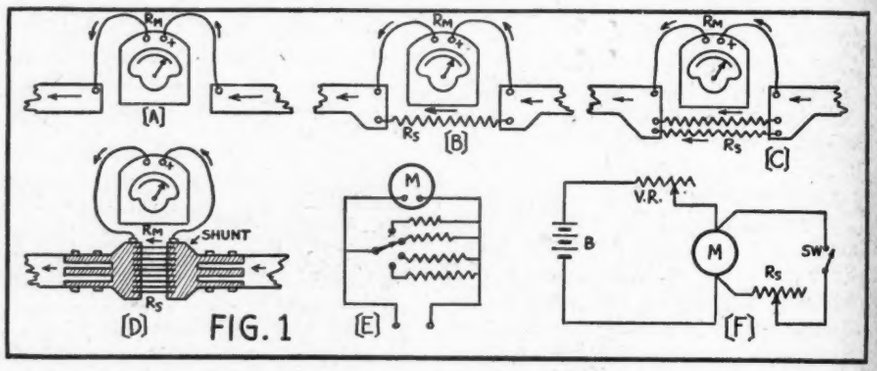


Figure 1. How shunts are connected to carry a definite fraction of the total current in a circuit, permitting the use of an ordinary galvanometer movement as an ammeter to measure large currents.

$$\text{therefore } N=\frac{I}{I_m}=\frac{10{,}000}{50}=200$$

$$\text{and } R_s=\frac{R_m}{N-1}=\frac{2}{200-1}=.01 \text{ ohm}$$

(approximately) Ans.

Thus a shunt resistor of .01 ohm must be connected across the meter. This should be of a size able to carry the current without undue heating. All readings as read on the old scale of the meter must now be multiplied by the multiplying factor N, (200 in this case) to obtain the correct reading in milliamperes.

A number of shunts may be connected across a meter and controlled by a low resistance contact switch, so that any one of them may be put in the circuit at a time. This arrangement is shown at (E) of Figure 1.

It is evident from the above problem, that in order to calculate the value of R_s by this method, the exact value of the internal resistance of the meter must be known. This information can be obtained from the manufacturer of the meter. The resistance of most small 2-inch and 3-inch diameter type milliammeters is in the neighborhood of 20 to 50 ohms.

Serviceman's Diary

(*Continued from page* 388)

with the set?" (I didn't have one.) It needed a new volume control also so I managed to corral the job anyhow. When I return, it will have to be the last call for the day as she will be gravely insulted if I don't taste her high-power wine. Well, it's all in the game.

Stopped off to look over an aerial job. Of course, on a busy Saturday afternoon we can't take the time to put in a first-rate installation of a noise-reducing system (but if we tell a customer that over the phone, we lose the job). The old antenna was dragging in the driveway, so I cut it off close to the house, then checked the set. Made a survey and some rather unnecessary measurements to determine the location and amount of lead-in wire needed, then postponed the antenna job until next week, having done just enough work (I hope) to hold the job for the time being.

Big Export Market for P. B. Sets

Chicago, Ill.—"Automatic Tuning is bound to be popular in foreign countries," says Art Maybrun, Export Manager of Trav-ler Radio & Television Corp. Mr. Maybrun finds that foreign markets are most favorable to tuning features, and it is his strong opinion that this year's American-made sets with their automatic tuning features will have very definite foreign appeal.

THE TECHNICAL REVIEW

CONDUCTED BY THE TECHNICAL EDITOR

A Short-Wave Journey of Discovery, by Hendrick Van Loon and Laurence M. Cockaday, RCA Manufacturing Co., Inc., 1937. Jointly the authors of this booklet have woven words into a magic carpet with which inexperienced owners of all-wave or short-wave receivers may explore with confidence the most fascinating regions of the radio spectrum. The old hand at dialing for distance will also find in this guide to short-wave listening a tabular co-ordination of the elusive facts concerning call letters, wave-lengths, program schedules and operating hours of all domestic and foreign short-wave broadcasting stations. A world map in colors showing time zones and locations of principal radio stations adds to the charm and effectiveness of "air-cruising" at any hour of the day or night. The booklet is illustrated by numerous line drawings executed in color in Hendrick Van Loon's inimitable style. National distribution of this publication is being effected through RCA-Victor dealers in principal cities and towns.

Television, Volume II, published by RCA Institutes Technical Press, 1937. A collection of addresses on the future of the new art and technical papers presented by members of the RCA engineering staff. Most of these technical papers are reprinted from the Proceedings of the IRE and from the RCA Review. All the lectures delivered at the IRE convention at New York City in May, 1937, are included. Within the 435 pages are 29 different articles dealing with the advances in television development. These include articles on kinescopes, iconoscopes, video amplifiers, ultra-short-wave transmission, etc.

Wireless Servicing Manual, by W. T. Cocking, third edition, Iliffe and Sons, London, England. This is a book intended for the British serviceman with the aim of teaching the principles of operation of modern receiving circuits and the location of troubles. It is not intended to teach radio from the beginning, the reader is assumed to have acquired this knowledge already. Yet, there is considerable material dealing with the principles of operation and design since the author evidently believes that such knowledge will be useful to the serviceman in interpreting unusual conditions. The American reader will of course meet unfamiliar terms and diagrams, also, some subjects would seem to have extra emphasis while others are omitted. There is, for instance, a section on regeneration which is not employed in commercial receivers here. On the other hand, there is no mention of automobile receivers with their special problems and all-wave receivers do not seem to be considered. Otherwise, the reader will find much helpful information on such subjects as motorboating, tracing hum, aligning, a.v.c. etc.

Automatic Frequency Control Systems, by John F. Rider, published by John F. Rider. From the prolific pen of Mr. Rider comes another volume, this time dealing with the newest improvement—a.f.c. The volume begins with reviewing certain principles, which are utilized in a.f.c. circuits, then explains the workings of the discriminator and the corrector circuit. Then follow descriptions of commercial applications, alignment procedure and servicing. The text is written in the usual clear style of the author and should be a valuable addition to the serviceman's library.

Tub Complement Book with I.F. Peaks, published by Hygrade Sylvania Corp. The main body of this work contains a listing of commercial receivers by make and model number, giving the tubes required and the intermediate frequency. Be-

sides this list, there is a wealth of other useful information. A list of trade-names with their manufacturers, a list of addresses of active manufacturers, important data on equivalent tubes, on dial lights and modernization of sets with new tubes are among the other features.

Review of the Proceedings of the Institute of Radio Engineers for October, 1937

A Negative-Grid Triode Oscillator and Amplifier for Ultra-High Frequencies, by A. L. Samuel. Description of a new triode which oscillates and amplifies at frequencies higher than previously reported. The improvement is due mainly to the arrangement of the leads.

Simple Method for Observing Current Amplitude and Phase Relations in Antenna Arrays, by J. F. Morrison. A simple arrangement which is useful for verifying the correct antenna adjustment.

Radiation from Rhombic Antennas, by Donald Foster. A direct theoretical determination of the transmitting properties of the horizontal rhombic antenna and of the closely related inverted V structure. Expressions are given for the intensity of radiation, the polarization, the radiation resistance, and the gain.

Review of Contemporary Literature

THE following are reviews of articles appearing in recent issues of technical magazines; the name of the magazine and its date are given after the title of each article. Copies of these articles are not included under the "Free Booklets"—they are available from your bookdealer or direct from the publishers. Addresses of publishers will be furnished on request.

Sudden Disturbances of the Ionosphere, by J. H. Dellinger, National Bureau of Standards Research Paper RP 1016. The results of a world-wide investigation of a sudden change in ionization of a portion of the ionosphere. It manifests itself by the complete fading out of h.f. radio transmission for a period of a few minutes to an hour.

A Peak-Reading Power-Level Indicator for Monitoring Broadcast and Sound Recording Circuits, by A. E. Thiessen, General Radio Experimenter, October, 1937. Description of a new instrument of wide range and employing an indicator with a very fast upswing but a slow down swing.

A New I.F. Amplifier System with Infinite Off-Frequency Rejection, by K. W. Miles and J. L. A. McLaughlin, QST, November 1937. This new coupling system combines capacitive coupling and inductive coupling in

(*Turn to page* 430)

QRD? QRD? QRD?

CONDUCTED BY GY

IN a recent broadcast over the NBC network, Brother George Clark, former president of the VWOA (Veteran Wireless Operators Association), spoke on "The Human Side of Marconi." Stressing all the wonders of science this "true benefactor of mankind" had discovered, he invited all his listeners to contribute towards the erection of a fitting monument to him.

The Marconi Memorial Fund was launched under the auspices of the VWOA. Known as Veteran No. 1, Marconi was an honorary member of this organization. Brother McGonigle vividly remembers the time when Marconi was presented with a special gold medal by the VWOA. It was on December 12, 1931 at the worldwide broadcast celebration of the conquest of the Atlantic by wireless communication. Marconi then said, "I am deeply touched at having been presented with such a generous token of appreciation by the VWOA. . . . I wish to assure you that your valuable gift will be treasured amongst the most cherished awards I have ever received." For this great man the monument to him will be a living symbol of the esteem in which he was held by the American radiops and the world at large. David Sarnoff of RCA, McCosker of Mutual Broadcasting, and many others have already generously contributed. Donations may be sent to the Marconi Memorial Fund, 30 Rockefeller Plaza, New York. A committee of prominent members of the communications industry and the allied arts, many of whom worked side by side with Marconi during the early days of wireless, will pass upon a suitable design for this "living tribute" to Marconi.

The VWOA, the veteran organization of radiops, in a recent communication advises that the new officers installed for the coming year are: President, Bill McGonigle; Vice President, Fred Muller; Secretary, H. H. Parker; Treasurer, S. C. Simon. All radiops wishing to know more about this association which has no special political affiliations, but is in accord with all organizations having for their credo the betterment of radiops, may do so by shooting their names into this department. Among their activities include building monuments, handing out scrolls of honor for meritorious radiop work.

Here's a tall one: The owner of the Yacht ARAS (WBED), which was lying in the harbor of Hamilton, Bermuda, went into the radio shack one day taking a tack to starboard and four sheets in the wind, and declaimed on the vagaries of radio, "sparks," the Constitution, and the world in general. Then he says, "I've got a friend in Wellington, New Zealand. Here's a message for him." Sparks shifted to 36 Mtrs with his RCA s.w. 200-W output job and slashed the atmospherics with the call ltrs ZLB. Much to his surprise and delight, ZLB answered his first call with an R5. In twenty minutes he had a reply to the msg and the owner sobered up with the shock!

In a touching scene aboard the SS Yukon, last rites were held for our departed brother, Frank I. Hoseth, when his ashes were scattered over the Gulf of Alaska on the 26th of August, 1937. Fifty-three years old, Hoseth had followed the sea since he was fourteen and for the past 25 years had been employed as a radiop on various vessels of the Alaska SS Co. All who knew Frank are saddened by his untimely death. He was an excellent companion and shipmate for whom every one had a friendly word. May his soul rest in peace with Davey Jones.

Brass pounders who can't read English can now peruse Karl Baarslag's SOS To the Rescue in Dutch, German and Swedish. And the Congressional Library has a special Braille edition for the Blind. As this goes to press Ye Ed learns that Oxford Press is running off a fifth edition in anticipation of Xmas demands. Meanwhile the globe-trotting author heads south for Biscayne Bay and a winter in the Caribbean and Florida waters. Lucky dog, say we. Some times we wonder how much Karl's book had to do with the government's sudden tightening of American radio legislation after years of snoozing. Karl's book was read by President Roosevelt, Senator Wagner and many other bigwigs who initiate legislation. As one of the 136 reviewers cracked, "Karl has filed a mighty indictment against the Federal Government and against 'big business' . . . the reader, unable to lay aside the volume until it is finished, will note . . . the losses of lives in the sinking of the Titanic, the capsizing of the Vestris and the burning of the Morro Castle . . . could have been materially lessened but for . . . laws

antiquated . . . and for the penuriousness of the shipping owners who . . . profit . . . by failing to protect their passengers with radio equipment or by failing to employ relief ops for 24-hour use of required equipment." This book is not only an entertaining and enlightening adventure story, or series of stories, but, if properly publicized, will go a long way in remedying the very apparent evils in navigation laws and practices.

Ah, me. Again it comes to pass. Some of the boys on the trawlers up around Boston Harbor way are drawing down $150.00 per month, plus $6.00 per barrel for fish livers. Put together, it spells an average of almost $190.00 per. But some of the radiops aren't satisfied with this arrangement and crave a flat rate of $200.00 per month and a few other choice items. Now it came to pass that about a year ago on the good ship HECLA the skipper-owner had installed a phone Xmtr. And this skipper has been having the time of his life bellowing into the mike. He hasn't had any trouble with the equipment to speak of and works on schedule with the beach. Well, a few of the trawler owners got together and declared if the boys went on strike for the raise in pay, they'd rather install the phone equipment. And they've got the courage and money with which to do it! Now the question is: If there is a strike, who voted it? The men out of jobs on the beach or the radiops working on the trawlers?

Whilst sitting around the Buzzer Room of the CUT MARDIV in New York, Ye Ed noticed lots of action. Men coming and going, buzzin' and buzzin', paying dues and receiving instructions. And speaking of going, Brother Cosmas has been doing some tall traveling across the country. Using every means of transportation including the "confounded air contraption," he has hopped from New York to Chi, back to Boston to somewheres else and thence to New Orleans. Yep, it's spreading out like a morning glory, growing and living. They're now putting out a small pamphlet-bulletin which will contain all the pertinent news of the organization and will be mailed to all members and to prospective members. They are taking larger space in their present building address to make room for their continual growth.

And as for Television, well, Brother David Sarnoff, who has just returned from England, states "The BBC has been operating its television Xmtr, located at Alexandria Palace in London, for about a year. The range is more than 25 miles and covers all of

(*Turn to page* 431)

The Technical Review

(*Continued from page* 427)

such a way that they can be made to cancel at a predetermined number of kilocycles off resonance.

Reactance Amplifiers, Electronics, October, 1937. Saturable reactors in conjunction with copper oxide rectifiers can be used as amplifiers requiring no tubes. These are suitable for industrial control purposes.

The Wave-Slot, an Optical Television System, by F. Okolicsanyi, The Wireless Engineer, October, 1937. A new system of scanning employing quartz crystals and supersonic waves in a liquid—no moving parts.

Hearing of Speech, by Bone Conduction, by N. A. Watson, Journal of the Acoustical Society of America, October, 1937. A report of tests performed by the author at the University of California.

FREE BULLETINS

Large 44 Page Catalog

Modell's just announced their latest 1938 catalog No. 409 which lists all the nationally known radio receivers and outlines a new representative

plan. Radio salesmen, servicemen, and any interested reader can obtain a free copy of this catalog by writing to RADIO NEWS, 461 Eighth Avenue, New York City.

New Tube Chart

Through the courtesy of the Raytheon Production Corp., RADIO NEWS readers can obtain a free copy of the new Raytheon's 11th edition Tube Data Chart. This chart measures 47 inches across by 22 inches wide, and is extremely useful to servicemen and dealers. Address requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Receiver Folder

The Freed Mfg. Co. announces a new folder which describes and illustrates the new 1938 Freed-Eisemann receiver line. This is free to RADIO NEWS readers for the asking. Simply address requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Folder on New I.F. Transformers

Copies of the latest Aladdin catalog No. 937 on their Polyiron inductors is available without charge to all RADIO NEWS readers. This book lists the complete line of Aladdin i.f. transformers. Write to RADIO NEWS, 461 Eighth Avenue, New York City.

RADIO NEWS Booklet Offers Repeated

FOR the benefit of our readers, we are repeating a list of valuable, FREE technical booklets and manufacturers' catalog offers, which were described in detail in the July, August, September, October, November, December 1937, issues. The majority of these booklets are still available to all readers. Simply ask for them by their code designations and send your request to RADIO NEWS, 461 Eighth Avenue, New York, N. Y. The literature marked with an asterisk is available only to bona fide servicemen, dealers and engineers. In applying for these folders it is necessary to send in your request on your card or letterhead. If you are an amateur give call letters. The list follows:

Jy2—Instrument Catalog. Triplett Electrical Instrument Co.

At1—Broadside on Super-Pro. Hammarlund Mfg. Co.

At2 — Catalog on Transmitting Equipment. Wholesale Radio Service Co., Inc.

At4—Tube Folder. Weston Electrical Instrument Corp.*

At5—P. A. Catalog. Webster Co.

S2—Transformer Catalog. Kenyon Transformer Co.

O1—Vibration Study with Neobeam Oscilloscope. The Sundt Engineering Co.*

O2—Sound Equipment Catalog. The Radolek Co.

O3—Instructive data for eliminating interference. The Sprague Products Co.*

O4—Catalog on "Nokoil" Speakers. Wright-DeCoster, Inc.

O5—Circular describing gas-engine a.c. electric plants. Kato Engineering Co.

O6—Replacement Condenser Catalog. Solar Mfg. Co.

O7—Guide Book on Peri-Dynamic Speakers. Jensen Radio Mfg. Co.

N1—Parts Catalog. Wholesale Radio Service Co.

N3—Catalog on Radio Accessories, Cabinets, etc. Bud Radio, Inc.*

N4—Allied Radio Corp. Parts Catalog.

D1—R.M.A. Color Code Chart. Free. Cornell-Dubilier Corp.

D2—Condenser and Resistor Catalog. Aerovox Corp.

D3—Technical Pamphlets on Intercommunication Systems. Wright-DeCoster, Inc.

D4—Transmitter Manual. Standard Transformer Corp.*

D5—"Skyrider" Receiver Booklet. Hallicrafters, Inc.

D6—The Muter Ballast Tube Catalog.*

D7—Centralab's Volume Control and Accessory Catalog.

QRD? QRD?

(*Continued from page* 429)

London and its immediate vicinity. The system employed is fundamentally based on the RCA Television System first developed here. . . . Some 15 British radio manufacturers have sets offered around $200 to $500 each. At the Olympia Radio Show all the manufacturers exhibited their latest sets and the BBC arranged special programs for them. From a technical viewpoint the results were highly satisfactory. But while hundreds of thousands purchased ordinary broadcast receivers, less than 100 television sets were bought. There are less than 2000 television sets in England. What RCA is waiting for is the erection of sufficient stations all over the country for commercial purposes and to bring good programs over a national setup. And as soon as this is all ironed out, television will be practically on its way to the public's front doorstep."

Across the Ed's elbow-rest come "bon mots" from Skagway, Alaska, amongst others. It seems that even in that far away tip, radiops want to be handling a key in some airways here in the States. And I thought the grass was greener there! Well, sir, most of the large airlines are pretty well lined up but if any of the brethren know of some of the spots which could place likely material from up in the silent North, just shoot it in and we'll pass it along. PanAm, AmAir, TWA, etc. are pretty well full-up. And whilst on the Northland subject, we note it's time for Santa Claus and the Xmas cheer and "Peace on Earth and all the Seas, Good Will to men." And may you all have a pleasant Xmas, a Happy New Year and all the fixings. So with a cheerio, ge . . . . 73 . . . . GY.

D. C. Voltmeter

(*Continued from page* 403)

R6A—IRC wire-wound resistor, type DHA, 12,000 ohms., 25 watts, set at 9800 ohms
R6B—IRC wire-wound resistor, type DG, 30,000 ohms., 20 watts
R7A—IRC wire-wound resistor, type DHA, 20,000 ohms., 25 watts, set at 15,000 ohms
R7B—IRC wire-wound resistor, type DG, 30,000 ohms., 20 watts
R7C—IRC wire-wound resistor, type DG, 40,000 ohms., 20 watts
R8—IRC carbon resistors, type BT½, 100 ohms, ½ watt, combined to total 195 ohms
R9—IRC carbon resistors, type BT½, ½ watt, combined to total 890 ohms
R10—IRC carbon resistors, type BT1, 1 watt, combined to total 5800 ohms
R11—IRC carbon resistors, type BT½, ½ watt, combined to total 12,500 ohms
R13—Yaxley potentiometer, type 17, 2000 ohms, wire-wound, linear
R14—IRC wire-wound resistor, type ABA, 25 ohms, 10 watts, set at 23.5 ohms
R15—IRC carbon resistor, type BT1, 20 ohms, 1 watt
S1, S2—H&H toggle switch, d.p.d.t.
S3—H&H toggle switch, s.p.d.t.
S4—H&H toggle switch, d.p.s.t.
S5—Yaxley range switch, 1315 L., 2 circuit, 5 positions, non-shorting
1—Yaxley pilot light bracket, type 310R
1—pilot lamp, 2 volt, 60 ma
2—Yaxley 1¼-inch black bar knobs No. 366
1—Yaxley Hex head tip jack No. 420, red
1—Yaxley Hex head tip jack No. 421, black
1—Triplett meter, model 421, 1 ma., square type
1—RCA type 30 tube
1—ICA engraved panel, special, 3/16-inch bakelite to fit cabinet
2—Eveready A cells, No. 711, 1.5 volts each
3—Eveready B batteries, No. 762, 45 volts each
1—Parmetal steel cabinet, type P.C. 1276, 12x7¾x6½ inches
1—Eby moulded 4-prong socket, type 12 Bakelite for two small sub-panels

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"Progressive" X'mitter

(*Continued from page* 411)

1 Parmetal type SB-78 set of mounting brackets
1 Parmetal type C-4526 chassis, cadmium plated, 10 by 17 by 3
1 Parmetal type CP-4526 bottom plate for chassis
1 RCA 6N7 tube
2 RCA 6L6 tubes (two more required later for high-power output)
1 Yaxley type 310G pilot light
1 octal wafer socket
1 wafer socket, 4-prong

Starts New Company

Chicago, Ill.—David E. Johnson, formerly president of the Dayton Radio Products Co. and recently sales manager of the Bendix-DayRad division of Bendix Products Corp, of South Bend, Indiana, will shortly start manufacture of a complete line of radio and electrical testing equipment at Dayton, Ohio. By arrangement with Bendix Products Corp., Mr. Johnson will provide renewal parts and authorized service on DayRad or Bendix-DayRad equipment now in use.

Studio on Wheels

Baltimore, Md.—Station WFBR now has a new mobile studio which is built on a trailer 25 feet long, 6 feet wide and 10 feet high. This mobile studio with its control room has all the equipment of the regular studios. It is to be moved by means of a truck which will carry a 500 watt transmitter and turntables. It is planned to visit every town in Maryland with this equipment, to transmit and record programs by local talent and to retransmit the recorded features later from the main station so the participants can hear.

WJBO'S DX PROGRAMS A REAL TREAT

Here's the control room of the new WJBO with Wilbur T. Golson, chief engineer. Listen for the Radio News "Extra Special" on Sunday morning, December 5, from 2 to 4 a. m., E.S.T.—and also the regular Radio News broadcasts at the same hours on the first and fourth Sundays of each month. The frequency is 1120 kc. and the power 500 watts.

THE DX CORNER

(For Broadcast Waves)

S. GORDON TAYLOR

DX CALENDAR

Below are given lists of special DX broadcasts. The initials following an item indicate the organization to which the program is dedicated and where a RADIO NEWS special has been arranged for by an Observer, his name is given in the schedule.

Don't fail to tune in the RADIO NEWS specials on this list and as many others as possible—and above all, don't fail to report to each station tuned in, giving them as much information as you can concerning their signal strength, fading, quality, etc. Where verifications are desired it is always desirable to enclose return postage.

Hours shown are Eastern Standard Time and are all a.m. unless otherwise indicated.

Day	Hour	Kc.	Call	State	Kw.	Club
			December			
1	2-2:30	1310	KWOS	Mo.	.1	NNRC
1	4-4:30	1370	WPAY	Ohio	.1	NNRC
3	3-4	1390	KRLC	Idaho	.25	NNRC
4	1-3	1160	XED	Mexico	2.5	
4	2:30-2:45	1280	KLS	Calif.	.25	URDXC
4	2:45-4	780	CHWK	Canada	.1	NNRC
4	3:30-4	1310	WEXL	Mich.	.05	NNRC
5	1-2	580	WILL	Ill.	1.	UDXC
5	**2-4**	**1120**	**WJBO**	**La.**	**.5**	**R. News Golson**
5	3-4	1180	KOB	N. Mex.	10.	IDA
5	4-5	580	WILL	Ill.	1.	UDXC
6	4:30-6	1310	WRAW	Pa.	.1	NNRC
6	**2:40-3**	**1240**	**WKAQ**	**P. R.**	**1.**	**R. News Sahlbach**
9	4-4:30	1370	WPRA	P. R.	.1	NNRC
10	1:30-2	1060	WJAG	Nebr.	1.	NNRC
11	1-3	1160	XED	Mexico	2.5	
11	2:30-2:45	1280	KLS	Calif.	.25	URDXC
11	3-4	1390	KRLC	Idaho	.25	NNRC
11	**5:40-6**	**1310**	**KXRO**	**Wash.**	**.1**	**R. News Sahlbach**
12	2-5	900	WFMD	Md.	.5	NNRC
12	2:45-4:30	1010	CKWX	Canada	.1	IDA
18	1-3	1160	XED	Mexico	2.5	
18	2:30-2:45	1280	KLS	Calif.	.25	URDXC
19	5-6	1420	KIUN	Texas	.1	UDXC
23	3-4	1130	WJJD	Ill.	20.	IDA
25	1-3	1160	XED	Mexico	2.5	
25	2:30-2:45	1280	KLS	Calif.	.25	URDXC
25	3-4	1390	KRLC	Idaho	.25	NNRC
25	3-5	1220	KWSO	Wash.	1.	
26	**2-4**	**1120**	**WJBO**	**La.**	**.5**	**R. News Golson**
30	1-2	1070	WTAM	Ohio	50.	IDA
31	5:30-6	1050	WEAU	Wisc.	1.	NNRC
			January			
(2	2-4	1120	**WJBO**	**La.**	**.5**	**R. News, Golson**
8	2-2:30	1310	**KWOS**	**Mo.**	**.1**	**R. News, Sahlbach**
8	4:10-4:30	1500	**WKBZ**	**Mich.**	**.1**	**R. News, Sahlbach**
8	5:10-5:30	1200	**KBTM**	**Ark.**	**.1**	**R. News, Sahlbach**
8	5:30-5:50	1200	**KFXD**	**Idaho**	**.1**	**R. News, Sahlbach**
8	5:40-6	1410	**KFJM**	**N. Dak.**	**5**	**R. News, Sahlbach**
10	4:20-4:40	1370	**KLUF**	**Texas**	**.1**	**R. News, Sahlbach**
10	4:50-5:10	1420	**KEUB**	**Utah**	**.1**	**R. News, Sahlbach**
10	5:50-6:10	1210	**KGLO**	**Iowa**	**.1**	**R. News, Sahlbach**
11	3:10-3:30	1260	**KPAC**	**Texas**	**.5**	**R. News, Sahlbach**
11	4:10-4:30	1370	KAST	Oregon	.1	UDXC
11	5-5:20	1370	**KRMC**	**N. Dak.**	**.1**	**R. News, Sahlbach**
11	5:50-6:10	1210	**KLAH**	**N. Mex.**	**.1**	**R. News, Sahlbach**
12	3:10-3:30	1210	**WPAX**	**Ga.**	**.1**	**R. News, Sahlbach**
12	4:40-5	1500	**KPLT**	**Texas**	**.25**	**R. News, Sahlbach**
12	5-5:20	1200	**KFJB**	**Iowa**	**.1**	**R. News, Sahlbach**
14	4-4:20	1210	**KIUL**	**Kans.**	**.1**	**R. News, Sahlbach**
14	5:30-5:50	1310	**WLBC**	**Ind.**	**.1**	**R. News, Sahlbach**
16	3-4	810	WCCO	Minn.	50.	IDA
16	5-6	1370	KOBH	S. Dak.	.1	UDXC
23	**2-4**	**1120**	**WJBO**	**La.**	**.5**	**R. News, Golson**
24	3-4	1150	WHAM	N. Y.	50.	IDA
30	3-4	780	CHWK	Canada	.1	IDA

Periodic

Mondays—
9:15-9:30 p.m., 690 kc., CJCJ, Calgary, Alta., Canada, .1 kw. (R. News) (tips)

Wednesdays—
12:30 a.m., 1390 kc., KOY, Phoenix, Aris., 1 kw. (tips).
1:45-2 p.m., 780 kc., WTAR, Norfolk, Va., 1 kw. (URDXC) (tips).

Saturdays—
1-1:10 a.m., 1390 kc., KLRA, Little Rock, Ark., 1 kw.

Sundays—
12:45-1 a.m., 1280 kc., KLS, Oakland, Calif., .25 kw (URDXC) (tips).
2:45-3 a.m., 1010 kc., CKWX, Vancouver, B.C., Canada, 1 kw.
3-3:30 a.m., 1410 kc., CKMO, Vancouver, B. C., Canada, 1 kw.
3:30-3:45 a.m., 570 kc., KMTR, Los Angeles, Calif., 1 kw. (tips).

Monthly—
1st day of month, 3-4 a.m., 1250 kc., WTOC, Savannah, Ga., 1 kw.
1st Sunday of month, 4-4:30 a.m., 1340 kc., KGDY, Huron, S. Dak., .25 kw.
2nd Tuesday of month, 5-5:30 a.m., 1370 kc., KRMC, Jamestown, N. Dak., 1 kw.

"Radio News" Broadcast

ON Friday, December 17, RADIO NEWS will go on the air with a special International program dedicated and directed to Official Listening Post Observers throughout the world. Among the features will be a talk by S. Gordon Taylor on the utility and DX possibilities of the new ranges below 10 meters. In order to insure world-wide coverage the broadcast will be repeated three times in all. The initial transmission will be from 4:00 to 4:30 p. m., E.S.T., and will take place over both W2XAF (9:53 megacycles) using its non-directional radiator, and W2XAD (15.33 megacycle) with its European beam. At 11:30-midnight the broadcast will be repeated over W2XAF, using its South American beam. Again at 7:00-7:30 the next morning (Saturday, December 18) the broadcast will go out over W2XAF. This time to listeners in Australia and other far-distant countries.

DX Corner

"Regular" DX

IT is the purpose of the DX Calendar to list special DX broadcasts, tips broadcasts, etc. There are quite a number of stations whose regular broadcast time extends into the early morning hours and which, therefore, provide an opportunity for DX work in the morning. A group of such stations as suggested by Observer Parfitt is listed herewith. The hours are all a.m.

E.S.T.	*Kc.*	*Call*	*Location*
5:00	840	XERA	Villa Acuna, Mex.
	1000	KFVD	Los Angeles, Cal.
	1040	KWJJ	Portland, Ore.
	1070	KJBS	San Francisco, Cal.
	1370	WABY	Albany, N. Y.
	1410	WAAB	Boston, Mass.
	1500	WJBK	Detroit, Mich.
5:30	750	WJR	Detroit, Mich.
	1200	WIBX	Utica, N. Y.
5:45	700	WLW	Cincinnati, Ohio
5:55	580	WIBW	Topeka, Kans.
6:00	570	WSYR	Syracuse, N. Y.
	920	WWJ	Detroit, Mich.
	930	KMA	Shenandoah, Iowa
	1070	WTAM	Cleveland, Ohio
	1160	WWVA	Wheeling, W. Va.

Mr. Parfitt has also suggested another list of "regulars" of special interest to listeners who do their DX'ing on Saturday night. These stations are on at the time specified on Saturday nights (or Sunday morning). All times are Eastern Standard.

Kc.	*Call*	*Hours*
570	WIND	to 5:00 a.m.
620	WTMJ	Irreg. 3 a.m.
640	KFI	to 3:00 a.m.
670	XELO	New freq. till 2 a.m.
710	KIRO	All night
840	XERA	All night
890	KFPY	to 4:00 a.m.
910	XENT	All night
940	XEFO	to 2:00 a.m.
960	XEAW	to 2:00 a.m.
1000	KFVD	All night
1030	CKLW	to 4:00 a.m.
1040	KWJJ	All night
1050	KNX	All night
1100	KGDM	After 3 a.m.
1100	KWKH	to 3:00 a.m.
1110	KQW	to 4:00 a.m.
1160	WWVA	to 2:30 a.m.
1200	WIL	to 5:00 a.m.
1250	WNEW	All night
1280	KLS	All night
1290	KTRH	to 3:00 a.m.
1300	WEVD	to 4:00 a.m.
1370	KCMO	to 5:00 a.m.

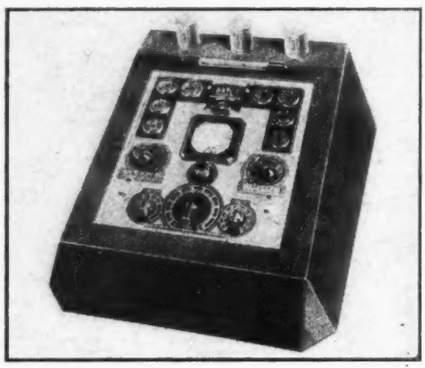
(*Turn to page* 447)

AT YOUR DEALER'S

NEW RADIO PRODUCTS

(*Continued from page* 406)

recently introduced by the Radiotechnic Laboratory features visual and aural indications of the condition of the tube under test, in addition to the usual meter test. Tube noises resulting from loose elements and intermitting shorts are made



plainly audible to the customer by means of a small earphone attached to the tester. Pressing the test button causes a light to appear red, amber or green, correspondingly for a bad, weak, or good tube.

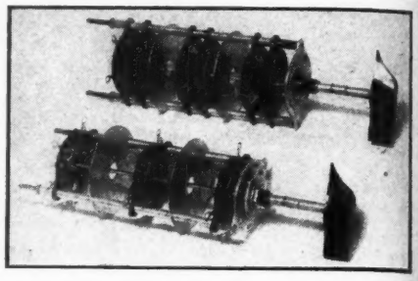
New Instrument for Modern Servicing

The Million Radio & Television Labs. announce a new a.c.-d.c. all-wave oscillator covering a frequency range from 100 to 25,000 kilocycles in 5 bands. The large dial is direct reading on all ranges providing over

40 inches of dial scale. A separate tube is utilized to furnish the 400 cycle audio modulation note, with its own attenuator for amplifier checks. The radio frequency attenuator system uses a buffer amplifier tube to permit high output for starting alignment. It is designed for simple, rapid, and convenient operation.

Universal Wave-Band Switches

Heretofore, the experimenter and home constructor found it extremely difficult to obtain suitable switches to meet the universal coil switching requirements in home built all-wave receivers. For this army of fans who like to "roll their own", P. R. Mallory and Company introduces two new Yaxley band change switches, type 153L and 156L, illustrated in the accompanying photograph.



The three section switch is designed for 3-band operation and accommodates two circuits per section or a total of six circuits. The six section switch is designed for 5-band service, one circuit per section or a total of six circuits. The contacts on this switch are double-spaced to provide easy wiring and to insure the lowest capacity between leads.

These new switches offer several constructional features indicating that careful attention was given to their design and application. They are built for extremely low contact resistance and minimum capacity between circuits; note the large shield between each section. Both switches are made with shorting shoes which short-circuit or ground all unused coils. The size of the switch has been figured out so that the overall length approximates that of a three-gang tuning condenser and the space between the decks coincides with the spacing of the sections in the typical gang condenser, thereby permitting short leads.

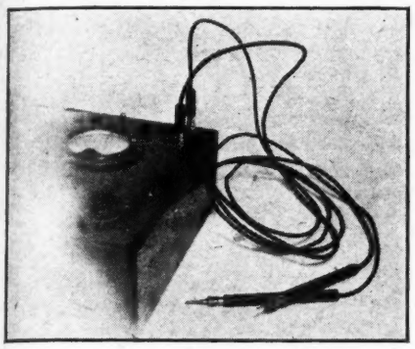
Armchair Radio

An attractve adaptation of the new armchair radio vogue is offered by the Allied Knight 7-tube all-wave receiver. It features an 8-inch dynamic speaker, automatic tuning of any ten favorite stations, a tuning electric eye, and others. The cabinet is pleasingly

styled of matched walnut woods. Tuning controls are recessed in the top and convenient shelves at both sides accommodate decorative pieces and books.

Heavy Duty Test Leads

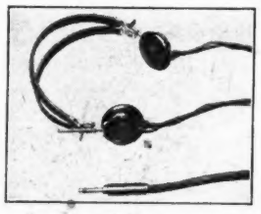
The Bud "Master" test leads are unusually well constructed, designed to stand up under hard usage. They are equipped with needlepoint tips of hardened steel to break through corrosion and insulation; and an im-



portant feature of these leads is the fact that worn or broken wires are easily replaced without soldering.

Announces New Headset

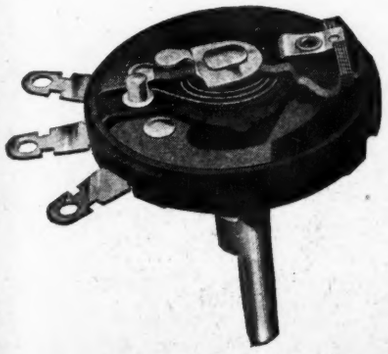
This is the new Trimm lightweight commercial headset especially made for aircraft, commercial, and amateur



operators. The high points of the headphones are rugged construction, high sensitivity, and response characteristics, substantially uniform throughout the usable voice range. The phones are designed to handle up to 1 watt without rattling. The absolute sensitivity is rated better-than 0.1 microvolt across the terminals for a barely audible signal.

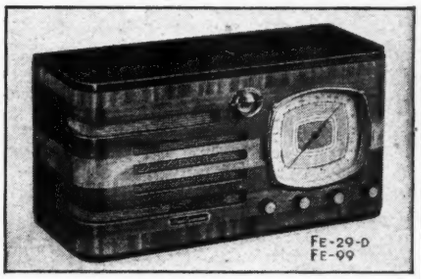
Noise Free Control

The International Resistance Company's latest line of volume controls with the "Silent Spiral Connector" is this company's answer to the demand for better, quieter controls for those critical special replacement jobs that cannot be handled with standard control types. By means of a spiral spring wire, positive and continuous electrical connection is obtained between the center terminal and the volume adjustment arm. This new control also has a "Knee Action" feature permitting a 5-finger element contact.



Covers Broadcast and Short-Wave Bands

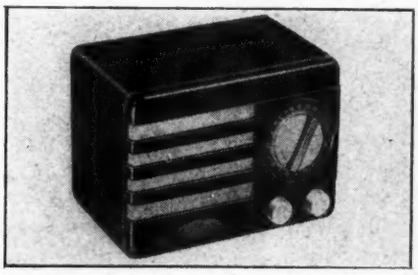
This is the new Freed-Eisemann



model 29D dual-band receiver. Foreign readers will be especially interested in this set as it is designed to operate from either alternating or direct current and it covers the short-wave ranges from 5.5 to 18 megacycles; in addition to the standard broadcast band, 550 to 1600 kilocycles. It is an 11-tube set and utilizes four of the new K34B type tubes.

New Table Set Presents Smart Appearance

This is the new Allied Knight a.c.-d.c. radio receiver inclosed in a new smart looking plastic colored cabinet. These bakelite enclosures are available in four colors; red, black, ivory, and walnut. Its wavelength range is from 75 to 550 meters, and the tube equipment comprises one 6D6, one

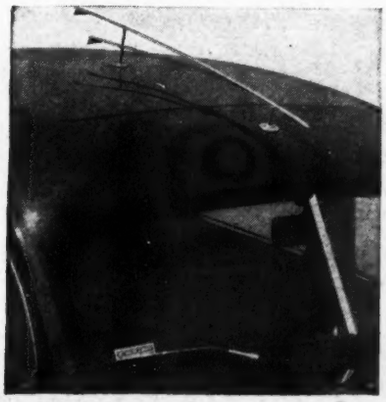


6C6, one 25L6, one 25Z5, and one L49C tube.

New Antenna for Greater Sensitivity

The Arrow model auto-top antenna produced by the Wedge Mfg. Company, mounting on rubber vacuum cups, has been

(*Turn to page* 448)



The "Ham" Shack

(*Continued from page* 409)

in the buttons after which they may be repaired only by repacking, a job which is almost as expensive as the microphone itself.

A number of crystal microphones of both diaphragm and sound cell types are manufactured by the Astatic Microphone Laboratories, Inc., of Youngstown, Ohio. The characteristics of these units follow:

Model D104

Output level.....-56 db
Type.....Single diaphragm crystal
Frequency range
Essentially flat from 60 to 4,000 cycles
Dimensions.....3" diameter, 1" thick

Model D2

Output level.....-64 db
Type.....Double diaphragm crystal
Frequency range
Within 2 db from 50 to 6,000 cycles
Dimensions.....2½" diameter, ⅝" thick

Model K2

Output level.....-64 db
Type.....Double diaphragm crystal
Frequency response
30 to 6,000 with 10 db rise at 10,000 cycles
Dimensions
Cylindrical 1¼" diameter, 2½" high

More than eight microphones of various types are offered the amateur by Shure Brothers, of Chicago. Their models are:

Model 70S

Output level.....-47 db
Type.....Single diaphragm crystal
Frequency response
50 to 6,000 cycles (Designed for voice work only)
Dimensions.....2¾" diameter

Model 700A

Output level.....-50 db
Type.....Curvilinear diaphragm crystal
Frequency response....40 to 10,000 cycles
Dimensions....Swivel head, 2⅜" diameter

Model 701A

Output level.....-50 db
Type.....Curvilinear diaphragm crystal
Frequency response...40 to 10,000 cycles
Dimensions
3½" high, 2⅛" wide. 1⅜" deep

Model 702A

Output level.....-50 db
Type.....Curvilinear diaphragm crystal
Frequency response....40 to 10,000 cycles
Dimensions
Spherical with 360 degree pickup, 2¼" diameter

Model 70H

Output level.....-60 db.
Type.....Single diaphragm crystal
Frequency response....30 to 10,000 cycles
Dimensions.....3" diameter, 1¼" thick

Model 750A

Output level.....-47 db
Type.....Single diaphragm crystal
Frequency response.....50 to 6,000 cycles
Dimensions
"Military Type" to fit in hand 3⅞" high, 1¾" thick

Shure "Tripolar"

Output level.....-54 db
Type
Crystal with controllable direction characteristics controlled by a three-position switch
Frequency response.....40 to 40,000 cycles
Dimensions.....5½" high, 2½" diameter

Model 85A

Output level...68 db below 1 volt per bar
Type.....Sound cell crystal
Frequency response....30 to 10,000 cycles
Dimensions
3½" high, 2⅛" high, 1⅜" deep

Model 3B

Type.....Double button carbon
Frequency response....50 to 4,000 cycles
Dimensions.....3½" diameter

Model 5B

Type.....Double button carbon
Frequency response.....50 to 5,000 cycles
Dimensions.....3¾" diameter

The Turner Company of Cedar Rapids, Ia., makes a number of popular models, principal among which is the VT-73. Its characteristics are:

Output level.....-47 db
Type.....Single diaphragm crystal
Frequency response.....40 to 8,000 cycles
Dimensions.....2⅜" diameter

A number of velocity type microphones designed for amateur use are manufactured by the Bruno Laboratories, Inc., of New York City. These include:

Model A

Output level.....-50 db
Type.....Static-type velocity
Frequency response
30 to 14,000 cycles (adjustable)
Dimensions..6" high, 2¼" wide, 1½" deep

Model WS

Output level.....-45 db..
Type.....Static-type velocity
Frequency response
30 to 14,000 cycles (Adjustable)
Dimensions....7" high, 3⅛" wide, 2" deep

Both of the above type microphones require a polarizing voltage adjustable from 150 to 350 volts.

Model VD

Output level.....-69 db
Type ..... Velocity
Frequency response....50 to 10,000 cycles
Dimensions
6½" high, 2 3/16" wide, 1½" deep

Model VR

Output level.....-67 db
Type.....Velocity
Frequency response....50 to 12,000 cycles
Dimensions
7¼" high, 3⅛" wide, 2 7/16" deep

Model WM

Output level.....-65 db
Type.....Wide angle velocity
Frequency response....50 to 12,000 cycles
Dimensions
7¼" high, 3⅛" wide, 2¼" deep

Model PR

Output level.....-61 db
Type.....Velocity
Frequency response....30 to 14,000 cycles
Dimensions..9" high, 4⅝" wide, 3⅜" deep

A number of velocity microphones are manufactured by the Amperite Company. These include inexpensive models as well as broadcast units. They are:

Model RBHK

Output level.....-65 db
Type
Velocity, available for both low and high impedance input
Frequency response.....40 to 11,000 cycles

Model RAL

Output level.....-68 db
Type.....Velocity
Frequency response.....40 to 9,000 cycles

Model SR-80

Output level.....-64 db
Type.....Velocity

Frequency response.....30 to 12,000 cycles

A number of dynamic type microphones recently have been put on the market. These include models made by the Western Electric Company and the RCA Manufacturing Company, Inc., of Camden, N. J. The ratings on these microphones are:

Western Electric Model 633A

Output level.....-65 db
Type.....“Salt Shaker” dynamic
Frequency response....40 to 10,000 cycles
Dimensions
Cylindrical housing: 3½″ long, 2″ in diameter

RCA “Aerodynamic”

Output level.....-68 db
Type.....Pressure operated dynamic
Frequency response....100 to 6,000 cycles
Dimensions..3″ high, 2⅝″ wide, 3⅜″ deep

RCA also makes a double button carbon microphone, the ratings of which are:

Output level.....-63 db
Frequency response.....50 to 6,500 cycles
Dimensions
6″ high, 3½″ wide, 2″ deep (in stand)

An extensive line of microphones also is manufactured by the Brush Development Company, of Cleveland, Ohio. They are:

Model B1

Output level.....-66 db
Type.....Sound cell crystal
Frequency response.....50 to 10,000 cycles
Dimensions..3½″ long 1⅞″ wide ¾ deep″

Model BR2S

Output level.....-66 db
Type...Sound cell using four crystal plates
Frequency response.....60 to 7,000 cycles
Dimensions.....Ball shaped 2⅛″ diameter

Model BL1

Output level.....-72 db
Type...Sound cell using four crystal plates
Frequency response.....60 to 7,000 cycles
Dimensions
Lapel type, 1¼″ high, 1¼″ wide ⅜″ deep

Model B2S

Output level.....-66 db
Type.....Sound cell crystal
Frequency response....50 to 10,000 cycles
Dimensions..3½″ high, 1¼″ wide, ½″ thick

Model G2S2P

Output level.....-70 db
Type.....Sound cell crystal
Frequency response....40 to 10,000 cycles
Dimensions..3″ high, 1¼″ wide, 1⅛″ deep

Model G4S6

Output level.....-64 db
Type.....Sound cell crystal
Frequency response....40 to 12,000 cycles
Dimensions..4½″ high, 1⅞″ wide, 1⅛″ deep

When used with a good speech amplifier, any of the above microphones will give excellent results in an amateur transmitter. The output level of the microphone will help in determining what amount of gain will be necessary in order to fully modulate a transmitter of a given amount of power. If a speech amplifier on hand does not have sufficient gain for the type of microphone used, a simple one or two stage pre-amplifier may be installed. It will be found with most velocity and dynamic types additional amplification will be necessary unless the speech equipment provides a gain of about 120db. or more.

THE AMATEUR OBSERVER

Conducted by W2JGR

FOR the benefit of American amateurs, the calls heard listed this month are mostly those reported by observers in distant countries. This publication of lists sent in by foreign listeners will also give American observers an opportunity to see what their foreign DX brothers are accomplishing.

* * *

It becomes more and more imperative that lists of calls heard on the 10 and 20-meter bands be limited to really DX calls. Many of the reports received persist in listing 20-meter stations only a few hundred miles distant. Three thousand miles would seem to be a logical dividing line for DX on these two bands.

* * *

The following two observers would like to correspond with other observers: Ray Bayer, 2314 La Salle Street, Racine, Wis., and James Arp, 706 Penn Street, Williamsport, Pa.

CALLS HEARD

By W2JCY, Laurence M. Cockaday, 547 Second Avenue, North Pelham, N. Y.

10 meters: D3CSC-5, D4YLI-9, GDF-7, AOR-5, QET-9, F3GR-9, HL-8, DN-7, LE-9, 8LX-9, XW-8, QD-9, QW-7, PY-7, WK-8, ON4FE-9, AU, JB-7, VU-7, NC-8, YL2CD-7, OK2RM-7, WV-7, OP-8, 3VA-9, LA1Y-9, ET2L-9, 9J-9, SP1HH-9, SM5OI-9, YH-7, VW-7, PAOBE-9, BD-7, FB-8, G2DC-9, IT-9, PL-9, AU-7, MF-9, 5KH-9, VM-9, BJ-9, BM-8, BY-5, CY-7, ML-9, 6WU-8, QB-9, VY-9, DH-9, BW-9, GF-7, LK-9, GO-7, LL-9, GS-9, 8QC-7, GW2UL-9, NG-8, 8CT-9, GM6RG-9, XI-9, NX-7, U2NE-9, 9ML-9, CT1AY-8, CN8AV-9, FY1Q-9, XE1AG-9, GE-9, A-7, K6MVV-9, OQE-9, LCV-9, BNR-7, MHY-8, OA4I-9, HK1JD-9, 4EA, PY2AC-8, HR4AF-9, K5AT-9, AG-9, LU3DH-9, 5FG-5, AN-6, 9BV-9, VP3BG-7, 5GM-9, PZ-5, VU2CO-8, AU-7, 6SW-5, ZS1AH-7, 6AJ-8, I-7, ZU5Q-5, 6I, P-9, ZT2G-8, 6AB-6, XY-5, I3JF-7, 5CC-5, 8CF-4, JMN3-8, FM8AA-6, VK2GU-9, ADE-7, 4TK-7, 5KO-8, HG-5, 6MU-8, ZL1DV-7, 2AL-7, 4AC-8, ZE1JJ-7, VO3X-7, 4C-8, HH5PA-8.

By N. C. Smith, "Somerden", 53 Birch Tree Road, Petts Wood, Orpington, Kent, England.

10 meter phone: W1EDW-6, COO-5, KXA-4, 2KHR-6, JQX-8, FHI-7, JIL-8, KAX-6, HFS-6, ICY-8, JOC-5, 3FVL-5, EGA-3, 4EDD-9, BYY-9, FT-7, ERH-5, 8NYD-4, AHC-4, VE1DR-5, 2KX-3, CN8AV-7.

10 meter c.w.: W1KTF-6, KQF-4, 2HGQ-6, BHW-5, 3EXB-3, 8AZD-8, CKY-5, SV1RX-6, U3FB-7, FM8AF-3, OE1EK-5, FA3JY-4, 8JO-8.

20 meter phone: W4OA, IF, BPD, OLH, EF, OC, CYU, 8NFF, HEQ, YL2CC, VO6L, CN8AM, SV1CA, CO2RA, 6OM, VE1LR, 3JV, EO, KA1YL, MH, SM5SI, 6WR, 7WA, LA5N, 6P, N, 7K, HA4A, SU1AX, SG, LU5AN, 8AB, VP6TR, PY1FR, ES5B, D, HH5PA, NY2AE, TF3P.

20 meter c.w.: W5FI, 8CUO, LYQ, 9FNK, LIR, OT, HKQ, PXZ, ZL3AZ, 4GM, AF, GA, ZS1AN, SU1WM, VK2UD, VN, YL, 4EL, UK5HA, VU2AN, K5AA, HS1BJ, ZU1D, U5RC, FI8AC, VE3FB.

By Ken Weale, 17 Cardinal Crescent, Dewsbury Road, Leeds 11, Yorkshire, England.

20 meter phone: W1JUG, 2IT, 2GVX, 2FGV, 2IPR, 2DH, 2IWT, 2JKQ, 2HFS, 2ZC, 2BSY, 2IXY, 2ETI, 3EKU, 3GAQ, 3MD, 3DWE, 3FGN, 3FH, 3FOJ, 3EOZ, 3BIH, 4CYU, 4DRD, 4UK, 4EEE, 6BW, 8ABC, 8OAR, 8LPI, 8OMJ, 9PDJ, K4ENY, 4BDA, VO1J, VE1CN, 1DX, 1AR, 1CR, PY1FR, 2BA, CN8AM, YV5AA, 5AE, LU4KA, 5CZ, VP6PR.

By Renato Brossa, at I1BAG, Chieri, Turin, Italy.

20 meter phone: SU1FS, 1FG, VE1CL, 2HG, W1BLO, IVA, 1QM, 1GAN, 2DH, 2ZC-9, 2IHI, 2ETI, 2HYH, 2AT, 2GS, 2WGO, 3CH, 4APA, 4CDQ, 4DCR, 9ESO, 9LFU, TI1AH, 2F, 3AH, 3CO, CO2AA, 2OK, 2RA, LE1AB, LS1AB, LU6ET, YV5EB, TY1FR, CE1AR, OR5PZ.

By Eric Gertenbach, 3 Molteno Street, Uitenhage, Cape Province, South Africa.

20 meter phone: W1JFT-4, 2AZ-6, 2IUV-8, 2AZI-5, 3DRA-6, 3FGN-5, 4HX-8, 5ZS-6, 6BPN-7, 6LYM-8, 6ISH-9, 6TT-9, 6CDO-7, 6CTG-7, 6AMG-7, 6NNR-9, 6BAW-5, 6JKR-5, 6GCT-9, 6AL-5, 6EJC-6, 6PB-7, 6ITH-9, 6IRX-6, 6AH-7, 6OSY-9, 6GM-6, 6MRP-7, 6OD-7, 6CNA-8, 6HOW-9, 7CEO-9, 7FQK-7, 7VA-5, 7ABF-7, 8DLD-9, 8ANO-9, 9TIZ-6, 9BAQ-8, 9UEL-7, LU3EJ-5, 5CZ-8, FB8AH-9, 8AB-7, PK1FF-8, 1MF-6, 2WL-7, 3AA-7, 3WI-6, 6HI-4, PY2ET-6, TI2KP-5, XZ2DY-4, PAOUN-5, 2DY-4, VE4MO-7, 5VO-9, ZE1JA-9, 1JR-9, ZS3E-9, CR7AU-9, 7AK-4, KA1ME-7, 1DT-6, K6BNR-7, 6NZQ-7, 6OOE-5, VS2AK-4, 2HS-5, 2CE-4, 2ABD-3, 4JX-4, 6MW-7, K7FBE-5, 4DDH-8, NY2AE-7.

By Oscar Westman, 24 Lawrence Road, Maitland, Cape Town, South Africa.

W2JC-8, 3AMH-7, 4DSY-8, 5EEM-7, 60RK-7, 6AB-7, 6CU-9, 6ISH-9, 6FTU-8, 6JKR-8, 6IPH-8, 6HOE-8, 6MBQ-7, 6CTG-8, 60HK-8, 6FMY-7, 6LYM-8, 7DC-8, 9RCH-9, 9FOP-7, 9FJ-7, YR5AP-8, ZS2J-9, 5AB-9, ZU1B-9, 6E-9, 6N-9, 6AF-9, VE4WJ-8, 4KZ-8, 5JK-8, 5JK-8, K4SA-8, 6JK-8, KA1ME-9, ZT6Y-9, VQ8AB-8, FB8AB-8.

By E. H. Walker, 23 Burlington Road, Chiswick, London, W4, England.

20-meter phone: SV1CA, 1KE, TG2S, YI2BA, FT4AR, 4AN, W1BLO, 1BTL, 1CRW, 1IFD, 1JUG, 1AJZ, 1JZA, 1CND, 1EBO, 1ADM, 1GED, 1APPA, 1FUY, 1DMV, 1BBX, 1GJX, 1IED, 1GEX, 1GYZ, 1HZQ, 2HCE, 2IXY, 2ZC, 2UK, 2JKQ, 2GIZ, 2BZ, 2CWC, 2DH, 2AZ, 2JT, 2HYT, 2AD, 2GVC, 2AWL, 2AVY, 2GSC, 2HX, 2HS, 2GO, 3FIH, 3DLL, 3ANH, 3BMA, 3EFS, 3FII, 3FAM, 3CC, 3EOZ, 3DRA, 3BEI, 3DYE, 3BIH, 3WN, 3CRI, 3HUQ, 3BSY, 4DHL, 4DSY, 4IS, 4CYU, 4EKL, 4EEZ, 4EEE, 4APK, 4AKY, 4EHG, 4WZ, 5EHT, 5ZS, 6CQI, 6LYM, 6AL, 6AM, 8NXY, 8JNU, 8OAR, 8FNN, 8BYF, 8IUG, 8BKA, 9ZDO, 9BBU, 9YGC, 9ATZ, 9FSY, 9MCD, 9NGZ, YV5AA, K4ENY, FA3JY, 8IH, LU3EJ, 5CZ, 9BV, VK2XU, 3KX, OE6MP, PY2AL, VE1JA, 1LR, 1CA, 1GP, 2HE, 3AGT, NY2AE, CE1AO, 3CO, HK3JA, TI2FG, 2AV, CO2AY, 2UG, 2RA, 2JJ, 2KL, 7HF, 7VP, HC1FG, 1JB, SV1KG, 1RO, 1SG, 8MA, CN8MB, 8AM, 8AL.

By W1IJ, Owen Shepherd, Jr., Madison, Conn.

5 meters: W1BJE-7, 1APJ-7, 1JLK-8, 1KNM-9, 1KTP-5, 1BCR-9, 1KJT-6, 1FHN-9, 1JSD-6, 1KQK-7, 1KPN-7, 1AVV-7, 1CDR-5, 1EYM-5, 1KRV-6, 1JVQ-7, 1DEI-7, 1GDJ-6, 1EER-8, 1HDF-7, 1JZJ-7, 1JUZ-3, 1ZE-8, 1FUB-6, 1KQR-7, 1BRL-4, 1CBG-9, 1CDA-4, 2CFT-4, 2IYL, 2HG-4, 2ICA-4, 2DTH-5, 2JCY-8, 2BNH-4, 2ST-7, 2MO-6, 2CUZ-5, 2EWO-5, 2DPG-4, 2EJP-6, 2HVK-6, 2HEJ-8, 2AMJ-7, 2COT-5, 2HNW-5, 2HHN-4, 3AC-7, 3EZM-5, 3GQS-6, 3EPPN-5, 3AXR-6, 3FBH-4, 3FVR-6.

By Claud H. Roberts, 30 Crogsland Road, Chalk Farm, London, England.

20-meter phone: W1BLO-8, 1ADM-4, 1APA-7, 1ADL-8, 1GED-8, 1TW-7, 1HKK-5, 1FNL-6, 1JFG-7, 1CCZ-9, 1BBX-6, 1IED-4, 1FH-9, 2DH-9, 2IJG-6, 2AYS-6, 2DYR-4, 2GSC-4, 2ZC-9, 2HUQ-4, 2FOA-8, 2HNP-6, 2CFH-4, 2KLH-9, 2HEI-8, 2HYT-6, 2CFU-8, 2IKP-6, 2KFH-6, 2HFS-7, 3EWN-8, 3EKU-6, 3GFU-6, 3GSU-7, 3FGN-8, 3BEI-6, 3MD-9, 3CRI-9, 3FII-9, 3ANH-4, 4DSY-7, 8HFE-6, 8BYF-6, 8NUN-9, 8DOL-6, 8MPX-8 9BBU-5, SU1KG-9, 1SG-9, EA9AH-6, CN8AM-9, VO2Z-8, VO1T-6, LU5CZ-6, CE2AB-6, CO6OM-9, VE1JA-6, 1GR-4, 1GP-4, 1LR-6, 2RU-4, 2HE-6.

By H. Westman, "Stony Hill" Listening Post, Huguenot, Cape S. Africa.

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By H. F. Hamilton, "Glenara," Shelvers Way, Ladworth, Surrey, England.

10 meter phone: K4EIL-6, 6MVV-4, TI2FG-6, VE2KX-5, VU2CQ-4, ZS6AJ-5, W5DQK-4, 5EYM-5, 5FDE-5, 5FNH-4, 6ITH-4, 6NLX-4, 7EMT-4, 9YOC-5.

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By R. T. Coales, 54 Chelsea Road, Southsea, Hampshire, England.

10 meters: VU2CQ, W5VV, 6NLS, 6ITH, 6CKR, 9AGO, 9SYG, 9UPX.
20 meters: KA1ME, 1JR, VK2XU, 2VV, 3XJ, 3AL, 5AW, VU2BG, PK1ZZ, 3WI, XE2FC, YI2BA, CE1AH, VE5OT, 5JK, VS2AK.

By H. L. Hirchberg, 38 Marney Road, London, S.W.11, England.

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By G. A. Clayton, Winscombe, Somerset, England.

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By P. L. Stiles, 20 Temple Sheen Road, East Sheen, London, England.

20 meters: VO1G-4, VS2AO-2, SU1SG-7, W1JFG-7, 1DAA-5, 2DH-5, CN8AM-7.

By G2CYW, Braintree, Essex, England

20-meter phone: W1CEW, 1JFG, 1CMD, 1JZA, 1JG, 1JUG, 1APA, 1ADM, 1AVM, 1KCK, 1NU, 1DET, 1BLO, 1TQO, 1WE, 1KRD, 1LI, 1KKT, 1AXA, 1FB, 1BVS, 1DYA, 1JVE, 1BBF, 1OM, 1JED, 2DH, 2HCE, 2BII, 2CCM, 2IUV, 2BR, 2JKQ, 2ZC, 2BBI, 2IDQ, 2BQV, 2BHI, 2WW, 2BFB, 2AZ, 2EIZ, 2HGK, 2FBD, 2FOA, 2MY, 2TOT, 2IYK, 2CIF, 2IXY, 2IBQ, 3MD, 3BGT, 3BEI, 3ZF, 3EWN, 3BRI, 3CHE, 3HN, 3MFD, 3FAM, 3EU, 3BYU, 3WM, 3ASG, 3EFS, 3FSD, 3BMA, 3FIH, 3DX, 3AIR, 3BVU, 3GY, 3FII, 3DLL, 4HX, 4BPD, 4ACU, 4IS, 4AKY, 4CYU, 4EBW, 4DCP, 4EQK, 4DRD, 5ZS, 5BCU, 6LGX, 6CQI, 6MTZ, 6QCH, 8FNN, 8AU, 8HP, SHEQ, 8OAR, 8FHB, 8TKP, 8PMA, 8SKS, 8IY, 8HUL, 9BDU, 9PYS, LA6N, OE6DT, YL2CC, F8QD, I1MX, 1MI, CT1AY, 1AI, 2AB, LA1G, OZ3U, CN8AL, SV1CA, SU1SG, ZB1H, 1L, 1E, ES5D, HA4A, SV1KE, F3CD, FT4AL, SU1CH, LA1F, VK3ZZ, HC1JW, NY2AE, VP9R, VS1AR, KA1YL, VS2AK, HK1D, YV5AA, VE1EI, 2DC, 2BG, 3KX, VO1P, 2V, 6L.

By G. C. Gallagher, 18 Delano Avenue, San Francisco, Calif.

20 meters: VK2AX, 3AL, 4JU, PK1JW, ZP6Y, ON4VK.

By Thomas P. Jordan, 1523 N. Main Avenue, Scranton, Pa.

10 meter phone: ZU6P-9.
20 meter phone: VO6L-9, 6D-8, OX2QY-9, G5JO-7, VP9R-9, ZU6P-7, FR8VX-5.

By Paul Wunsch, Jr., 387 Clifton Ave., Clifton, N. J.

20 meters c.w. and phone: ON4DM-6, 4MY-6, 4RX-7, U1AD-4, LU4BL-7, VP9R-6, YV2CU-3, 5ADA-8, 5AA-8.

By John Frederick, P. O. Box 325, West Linn, Oregon.

20 meters: CE1AO, 3DW, HC1JB, 1FG, OA4AL, LU1HI, YV5AJ, HK3MG, CO2LY, 2RA, 2CC, ES5D.

By L. F. Gallagher, 307 East 17th Street, New York, N. Y.

20 meter phone: VO6D-9, 6IQ-9, VP9R-9, 9G-8, 9O-7, VS6AK-5, VU2CQ-7, F3VX-7, 8QD-7, 8OO-8, G2PU-8, 2HF-5, 2PO-3, 2OA-8, 5BI-6, 5ML-5, 5ZA-5, 5NI-4, 5LU-7, 6BA-7, 6HW-6, 6IF-7, HH5PA-9, HK2AL-4, EI2L-7, 4F-6, CX1CB-8, 1CX-8, 3BL-6, GI6TK-8, ZE1JR-5, 1JF-7, HC1JD-9, PK4MY-7, PY1FR-8, 1DK-7, 7AY-8, NY1AA-7, 2AA-7, 2AE-6, TI2FT-7, 2FG-7, 2CT-8, 3RE-8, YL2TC-8, CE3AA-8, ZD1JR-7, XU3FK-6, EA8AE-8, SU1SG-7, LU6AX-7, 9BB-9, 9DD-8, ON4KM-7, YV5AA-8, OA4V-8, 4A-7, 4N-8, 4AL-9, CT1AY-7, YR5DY-7, EA1AY-7, 7AI-6, ZD6AM-8, 6YP-9, 6YA-7, 6AJ-9, ZU1CM-8, 6AF-8, 6AS-7, ZS6AI-7.

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By John B. McGowan, 66 Bedford Road, Woburn, Mass.

20 meter phone: CT1AY, CN8AL, EI2J, 2L, FT4AN, HC2CJ, HH2B, KA1ME, LA1F, LU3EJ, 8AB, ON4HW, 4PA, 4SS, OA4R, PAOAD, OBE, ONP, PK1GL, SU1RK, SV1KE, 1NK, SM7YA, TI2AV, 2LR, VP9R, VK3BZ, 3KX, 3LA, 3ZZ, XE1BT, 2FC, 2HD.

By R. F. Shamleffer, 1404 E. 124 No. 4, Cleveland, Ohio.

20 meter phone: G2PU-5, 5NI-9, 6IA-8, 6GF-8, YV5AE-9, 5AGF-9, SU1CH-5, HK1EP-7, 4AG-5, OA4N-4, EI2L-9, LU7BK-5, EA9AH-8, VO6JO-9, 6D-6.

By Sidney G. Millen, 40 Wayland Street, Boston, Mass.

10 meter phone: G2HX-9, 5IO-6, 5GO-7, 5SA-6, 6DH-5, 6LC-7, 6LK-8, 6BL-6, 6BW-8, 6AG-8, 6WH-5, 8SA-8, GW2UL-7, GM6RG-9, F8KI-8, 8OD-7, 8WK-6, EI2LE-8, K5AT-8, VO3X-8, CN8AV-7, VP6YV-8.

By Albert Augustine, 7929 Eastwick Avenue, Philadelphia, Pa.

10 meter c.w.: EI5F-7, 6G-7, F3KH-8, 8RR-8, 8BS-7, 8TQ-8, G2MF-7, 2XC-7, 2PL-7, 5LI-7, 5VB-7, 5BI-7, 5VU-7, 5QY-7, 5KM-8, 6NF-7, 6YL-7, 8SB-6, GM6RV-7, HH3L-6, HK4EA-9, HR4AF-8, OK1CX-6, 1FF-7, 2MV-7, 3VA-8, PAOAZ-7, ZS1AH-7.

10 meter phone: EI9J-7, G2IT-7, 5CY-7, 5BM-7, 5IQ-7, 5SA-7, 5ML-9, 6DH-7, 6YR-7, 6BW-8, 8SA-7, GM6RG-9, GW2UL-8, HK1JD-7, K6OQE-8, LU9BV-8, ZT2G-6, 6AK-7, ZS6AJ-6.

20 meter c.w.: CN8AH-7, CX1BK-8, 1CG-8, 2AJ-5, D4HSG-7, 4KMG-7, 4QNM-7, 4SNP-7, FA8DA-8, FY8E-8, I1IR-7, LA4P-7, VK2AD-8, 2AHA-8, 2DG-7, 2FF-7, 2HZ-8, 2NG-7, 2PX-7, 2QL-8, 2QE-7, 2TF-7, 2TI-8, 2XQ-6, 2XT-8, 2ZC-5, 3GD-4, 3GP-7, 3NG-8,

(*Turn to page* 447)

Antenna A. B. C.'s

(*Continued from page* 419)

large voltage and a small current (high impedance). The load would be more receptive to this high ratio if it had the same high impedance. The converse is true.

Since the center of a half-wave Hertz antenna is at low impedance we can efficiently load the wire if our source of r.f. energy also has a low impedance. In Figure 3 we see a coil of a few turns connected at the center of the radiator and coupled to the tank coil of a transmitter. We have here a step-down transformer. The high voltage and low current of T is transformed into a comparatively low voltage and high current in A, which therefore matches conditions at the center of the radiator. The two quarter-wave lengths act as one continuous half-wave wire, except for a slight increase in wave-length of the antenna due to the presence of the coil. In the case of a full-wave wire we find that the points of low impedance occur at points a quarter-wave from either end. The coil could therefore be placed at either of these points, and since in this instance we have a center of high impedance, the coil would transfer little or no energy if connected at the center.

Figure 3 is not a very convenient arrangement. We wish the antenna to be placed away from other objects which might affect it, and the tank coil belongs in the station. To remedy this condition we can use the set-up of Figure 4. We can now separate the radiator from the coupling coil and use "feeders" to connect them. In this circuit, arrows indicate points of high current and its direction, while plus and minus signs indicate points of high voltage and its polarity. Conditions on the radiator are the same as if we had no feeders. Electrons traveling to the right come down the feeder but just as many are coming up the other feeder and along the radiator to the right. Impedances are matched both at the station and at the antenna and we can expect efficient loading of the transmitter.

The variable condensers are used to counteract the effect of the coil in the circuit so that the natural wave-length is neither increased nor decreased. By using one in each feeder balance is maintained. This question of balance of the two feeders is very important. By following the arrows we can see that (assum-

(*Continued on next page*)

ing the feeders of equal length) the currents in them are everywhere out of phase. The magnetic field of one will then be out of phase and will cancel that of the other so that no radiation can take place from them. The feeders must not be separated more than about 10 inches and must be fastened so that they do not swing. Another consideration is as we see from the plus and minus signs the necessity of good insulation. At these signs voltage is high and serious losses will take place unless the insulation is good.

The dotted lines in Figure 4 show that the feeders can also be a full wave-length. Every time we add a half-wave we come back again to a point of low impedance and can insert our coupling coil. The feeders then can be any multiple of a half wave-length. By placing r.f. ammeters at points of high current (as X and Y) we can determine if our feeders are balanced and therefore non-radiating. Variation of the condensers will bring about balance if the system is operating properly. The system just described is a current-fed feeder arrangement since it feeds the antenna at a current loop.

Zeppelin Antenna

Figure 5 illustrates an antenna which is fed at a voltage loop. This is commonly known as the "Zepp". According to the diagram we see that we need feeders of a quarter wave-length each. A voltage loop will appear at the ends of the feeders and will match the impedance at the radiator end. In other ways it can be considered similar to the balanced arrangement previously considered. The theory is the same if we consider the "Zepp" a full-wave antenna with part folded over onto itself so that only half is radiating. Similarly, we can consider Figure 4 to be a one and one-half wave antenna with part folded. The dotted lines show that we can add any number of half-wave lengths to the feeders and come back to a current loop at the coupling coil. The feeders will have an odd number of quarter-waves standing in this voltage-fed type as against an even number for the current-fed feeders.

Harmonic Operation

In the above systems we find that changes must be made in order to operate at harmonics. In Figure 4, for example, we will have voltage loops at the center for all even harmonics and cannot have a low impedance feeder connected to it. It would work, however, on odd harmonics in which case current loops would appear at the center. In Figure 5 we will always have a voltage loop at the end of the radiator, but on further inspection we see that on even harmonics a voltage loop appears on the low impedance coupling coil and cannot be matched as before. It can be used, though, on all odd harmonics when we get back to a current loop at the coil.

A simple voltage-fed antenna system which can be used on all harmonics is shown in Figure 6. This is a variation of the "Zepp" feeder system. The entire length of wire up

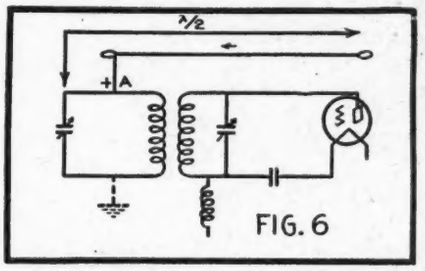

FIG. 6

to the point A on the tuned circuit is the antenna and will radiate. It may be considered a parallel-tuned "Zepp" without the second feeder wire. Among the disadvantages of this antenna are the following: A high voltage point is brought into the station which may affect receivers, neutralization and produce losses if the insulation is poor. Also because of the single feeder wire, radiation will take place from the entire wire. However, its great advantage is that it will function at all harmonics since the point A will always have a voltage loop standing on it. Also, by means of a ground connection we can convert the system into a Marconi aerial which can be used on half the fundamental frequency.

To Protect John Q. Public

New York, N. Y.—Observers in New York and other major cities report that misbranded inferior radio receivers, tubes and other equipment have virtually disappeared from shop windows following a clean-up instituted in New York City and Newark by authorities acting in the public interest. Violations of the Penal Laws of the State of New York brought twelve convictions and sentences. The defendants were convicted of selling spurious sets bearing the well-known trade-marks "Victor", "Brunswick" and "Edison."

Plan Facsimile Test Broadcasts

Washington, D. C.—A recent F.C.C. bulletin disclosed that six applications have been received in the past three months for permits to establish facsimile experimental broadcasting stations. Permits were granted station WGH, Hampton Roads Broadcasting Corp., Newport News, Virginia; and station WHO, Central Broadcasting Company, DesMoines, Iowa.

The DX Corner
(Short Waves)

(Continued from page 418)

North America

CRCX, Toronto, Ontario, Canada, 5125 kc.-6090 kc., heard 7 a.m., relays CRCT (Alfred), week days only 7:45 a.m.-5 p.m. (Meehan). Address: Canadian Broadcasting Corp., Toronto.

CFRF, Toronto, Ontario, Canada, 6070 kc., heard 10:30 p.m. (Harley).

CJCX, Sydney, Nova Scotia, Canada, 6010 kc., reports are requested (D'Orsay).

CFRX, Toronto, Ontario, Canada, 6070 kc., daily 7-12 p.m. (Unger). Address: 37 Floor St., West Toronto.

CJRO, Winnipeg, Canada, 6150 kc., heard 4-10 p.m. (Lindner).

XEBR, Hermosillo, Mexico, 11,820 kc., heard 10-12 p.m. (Fleming).

XEBT, Mexico, D. F., Mexico, 6000 kc., daily from 5 p.m. (Westman, Diez), heard 8 p.m. (Coover).

XEWW, Mexico, D. F., Mexico, 9485 kc., heard 9-12 p.m., 15,160 kc., 6-9 p.m., relays XEW (Alfred), heard 2-12 p.m. (Welper, Wollenschlager, Pierce), 15,140 kc. (Diez), daily 7-12 p.m. (Dressler, Shamleffer). Slogan: "The Voice of Latin America." Address: P. O. Box 2516.

XEFT, Vera Cruz, Mexico, 9550 kc., heard 10-12 p.m., chimes, cuckoo call, and bugle used (Welper, Diez).

W2XAF, Schenectady, N. Y., 9530 kc., daily 4-12 p.m. (Welper, Patrick, Harley, Lander, Unger, Mesarana, Fleming).

W1XAL, Boston, Mass., 11,790 kc., 6040 kc. (Harley), 15,250 kc., experimental freq. (Welper, Millen), daily except Saturday and Sunday (11,790 kc.), 4:45-6:30 p.m. (6040 kc.), 7-9 p.m. Saturday (11,790 kc), 1:45-6:30 p.m., Sunday 5-7 p.m. (Shamleffer, Fleming, Westman, Allison).

W9XF, Chicago, Ill., 6100 kc., heard 10:30-11 a.m. (Harley, McCue).

W8XAL, Cincinnati, Ohio, 6060 kc., heard 11:05 p.m. (Harley, Mesorana).

W2XAD, Schenectady, N. Y., 15,330 kc., daily 10 a.m.-8 p.m. (Welper); Wednesday 7-10 p.m., Sunday 7-9:25 p.m. (Unger, Shamleffer, Beard, Diez); 15,290 kc., daily except Saturday, 2-9 p.m., Saturday 11 a.m.-9 p.m. (Fleming).

SOUTH AFRICAN OBSERVER
This is Allan B. E. Goetsch, observer for Idutywa, South Africa. His receiver is a 27-tube Scott and he can record received programs.

W2XE, New York, N. Y., 15,270 kc., daily except Sunday 2-5 p.m., Sunday 4-5 p.m., 11,830 kc., daily except Sunday 5:30-11 p.m., Sunday 6-11 p.m. (Welper, Fleming); 17,870 kc (Diez); also 6120 kc., 17,760 kc., and 21,520 kc. (from veri) (Margorie).

W3XAL, Bound Brook, N. J., 17,780 kc., heard 8 a.m.-8 p.m. (Welper, Harley, Chadwick, Chokan, Van Os, Mesorana, Diez); 6100 kc., Fleming).

W3XAU, Philadelphia, Pa., 9590 kc., daily except Sunday and Wednesday 11 a.m.-7 p.m. (Welper, Patrick); 6060 kc., daily 7-11 p.m. (Fleming, McCue). Address: W. O. A. U. Building, 1622 Chestnut St.

W8XK, Pittsburgh, Pa., 11,810 kc., daily 9 a.m.-7 p.m. (Welper, Patrick); 15,210 kc. and 11,870 kc. (Fleming); 6140 kc. (Oglesby, Diez, Allison, Shamleffer).

W1XK, Boston, Mass., 9570 kc., heard daily 7 a.m.-1 a.m. (Welper, Patrick).

W9XJL, Superior, Wis., 26,100 kc., desire reports (Harris, Maxwell).

KKQ, Bolinas, Calif., 11,950 kc., heard 11:30 p.m. (Welper), heard Wednesday 9 p.m. (Myers), heard 8-9 p.m. (Kentzel)

W9XAA, Chicago, Ill., 11,750 kc. (Diez), 6080 kc., daily 6-11 p.m. (Fleming), 11,830 kc. (Atherton).

Central America

TIPG, San Jose, Costa Rica, 6410 kc., heard 10 p.m. (Shamleffer), 11,710 kc. (Diez). Slogan: "La Voz de la Victor."

TIEP, San Jose, Costa Rica, 6696 kc. (Diez), heard 7 p.m. (Coover).

TILS, San Jose, Costa Rica, 5800 kc., daily 7-11:50 p.m. (Fleming).

ZIK2, Belize, British Honduras, 10,560 kc., heard irregularly 7:15-8 p.m. (Fleming).

TG2X, Guatemala City, Guatemala, 5940 kc., daily 9-12 p.m. (Fleming).

YSM, San Salvador, El Salva-

dor, 11,710 kc., Sunday 9-9:30 p.m. (from veri), (Alfred, Partner, Diez, Birnie, Knight). Slogan: "Radio Nacionales." Address: Telegrafas, Telefonas Y Radio Nacionales, Direccion General, El Salvador.

YSD, San Salvador, El Salvador, 7890 kc., daily 9-10:30 p.m. (Alfred, Gallagher, Eder). Address same as YSM.

YNAM, Managua, Nicaragua, 7200 kc., daily 9-11 p.m. (from ann.) (Fleming).

HP5A, Panama City, Panama, 11,700 kc., heard 6-10 p.m. (Welper) (from veri), (Alfred, Millen, Unger, Magnuson, Partner, Diez, Dressler, Coover), daily 5-10 p.m. (Fleming, Shamleffer). Slogan: "Radio Teatro Estrella de Panama." Address: P. O. Box 954.

HP5L, David, Panama, 11,740 kc., heard 4-7 p.m. (Welper).

HP5J, Panama City, Panama, 9690 kc. (Unger, Diez), 9590 kc., daily 5-10:10 p.m. (Fleming). Slogan: "The Voice of Panama."

South America

OAX5A, Ica, Peru, 9630 kc., irregularly 7-9 p.m. (Alfred). Slogan: "Radio Universal de Ica."

OAX4T, Lima, Peru, 9630 kc., daily 6 p.m.-1:30 a.m. (Margrie).

OAX4Z, Lima, Peru, 6082 kc., daily 5-11 p.m. (Margrie). Slogan: "Radio National." Address: Avenida, Abancay 915.

HJ7ABD, Bucaramanga, Colombia, 9630 kc. (Meehan); desires reports (Shamleffer); daily 10-12 a.m. and 4-10 p.m. (Geneve, Markuson, Atherton, Betances, Kentzel); reports requested (Gallagher, Magnuson). Slogan: "Radio Bucaramanga."

HJ2ABD, Bucaramanga, Colombia, 9630 kc., 7-10:30 p.m. (Lindner, Fleming). Slogan: "Radio Bucaramanga."

HJ4ABH, Armenia, Colombia, 9520 kc., 9:30-10:20 p.m. (Welper, Wollenschlager); daily 6-10 p.m. (Dressler, Shamleffer).

HJ3ABD, Bogota, Colombia, 4841 kc., daily 7-10 p.m. (from veri) (Alfred Nigh). Slogan: "Colombia Broadcasting."

YV1RL, Maracaibo, Venezuela, 5930 kc., weekdays 11 a.m.-1 p.m., 4:30-9:30, Sunday 8:30 a.m.-2:30 p.m. (from announcement) (Markuson).

YV2RB, San Cristobal, Venezuela, 5720 kc., daily 6-11:30 p.m. (Cindel).

YV5RC, Caracas, Venezuela, 5800 kc., 6 p.m. (Coover); daily 6-10:30 p.m. (Fleming, Shamleffer); relays YV5RA (Markuson).

(*Continued on next page*)

3 New American Tubes

New York, N. Y.—RCA has announced three new tubes to be designated 1608, 1609 and 1610 which are now available through transmitting tube distributors. The 1608 is a transmitting triode suitable for Class B and Class C amplification and as an oscillator. It may be operated at maximum ratings up to 45 mc., up to 70 mc. with plate voltage and plate input of 75 percent of maximum ratings. The maximum plate input per tube is 40 watts and maximum plate dissipation 20 watts in Class C telegraph service. The filament requires 2.5 volts at 2.5 amperes while the maximum plate voltage is 425 volts. A pair of these tubes will deliver 50 watts as Class B audio amplifiers, 10 watts as Class B "linear", 18 watts as plate-modulated Class C amplifier and 27 watts as a Class C amplifier for c.w. or as an oscillator.

Type 1609 is a pentode voltage amplifier of low microphone design for pre-amplifiers. It is a direct heated tube requiring a filament supply of 1.1 volts at 0.25 amperes. Maximum plate supply is 135 volts. The amplification factor is 300, transconductance 725 micromhos and plate resistance 0.4 megohms. It does not have a grid cap, all connections coming out at the base. The socket layout is the same as for type 33.

Type 1610 is a direct-heated pentode intended for use as crystal oscillator. It may be operated at maximum ratings up to 20 megacycles, at 75 percent of maximum ratings up to 110 megacycles. The maximum plate dissipation for Class C service is 6 watts. The filament is rated at 2.5 volts, 1.75 amperes. Maximum plate potential is 400 volts; screen, 200 volts. The tube delivers approximately 5 watts output. The socket connections are the same as for type 47.

More Phone Systems

Camden, N. J.—The RCA Manufacturing Company is placing on the market, two RCA-Victor inter-office communication phone systems, one of which is of the "wired-wireless" type.

6AC5G

Pawtucket, R. I.—A new output tube, the 6AC5G, has been announced by Triad. This tube is intended to be used in connection with a 76 driver and employing "dynamic coupling," that is, the load of the 76 tube is to be placed in the cathode circuit and this cathode connects to the grid of the 6AC5G. A single ¼ megohm resistor is the only other part required in the circuit of both tubes, it is connected between grid and cathode of the power tube. The tube requires 6.3 volts for the filament at 0.4 ma. With a plate supply of 250 volts, the rated power output is 3.7 watts and the total harmonic distortion ten percent.

6F8G

New York, N. Y.—A new double triode tube, the 6F8G, has recently been announced by Raytheon. It is a 6.3 volt filament tube requiring 0.6 ampere filament current. The two triode sections have independent cathodes which greatly increases the possibilities of its use. Electrically, the characteristics of each triode section is similar to the 6J5G. With a plate potential of 250 volts, the recommended grid bias is 8 volts and the plate current 9 ma. The amplification factor is 20, the mutual conductance 2600 micromhos and the plate resistance 7700 ohms.

CXA8, Montevideo, Uruguay, 9640 kc., daily 8-11 p.m. (Gallagher, Shamleffer). Address: Belgrano 1841, Buenos Aires.

HC2JSB, Guayaquil, Ecuador, 7854 kc., daily 9 a.m., 2 p.m. and 4-11 p.m. (Markuson). Address: P. O. Box No. 805.

LRU, Buenos Aires, Argentina, 15,290 kc. (Diez); daily 7-9 p.m. (Markuson).

LR3, Buenos Aires, Argentina, 9645 kc., daily 12-11 p.m. (Westman). Slogan: "Radio El Grando."

West Indies

HIT, Trujillo City, Dominican Republic, 6630 kc., daily 5:40-8:40 p.m., Saturday 10:40 p.m.-12:40 a.m. (Cindel).

HIL, Trujillo City, Dominican Republic, 6500 kc., daily 4:40-5:40 p.m. (Betances); daily until 9 p.m. (Markuson). Slogan: "Emisara Diario Nacional."

HI1X, Trujillo City, Dominican Republic, 5980 kc., 8:20-9:30 p.m. (Harley); 6340 kc., relays HIX (Patrick).

HI2X, Trujillo City, Dominican Republic, 11,960 kc., relays HIX, daily 8:30-8:45 p.m. (Patrick). Signed Wednesday 9:50 p.m. (Myers).

HI1A, Santiago, Dominican Republic, daily 3:10-4:40 p.m. (Betances).

HH3W, Port-au-Prince, Haiti, 9650 kc., 7-8 p.m. (Nigh).

COKG, Santiago, Cuba, 6200 kc., 5-9 p.m. and 10-11 p.m. and 12-2 a.m. (Cindel).

COCE, Havana, Cuba, 9830 kc., daily 4-11 p.m. (Westman).

COCW, Havana, Cuba, 6330 kc., 7-11 p.m., relays CMW (Alfred, Millen, True, Scala, Betances, Atherton). Slogan: "La Voz des Antillas." Address: P. O. Box No. 130—Director Tecnico, Peso de Marti.

COBX, Havana, Cuba, 9150 kc., daily until 11:30 p.m. (Markuson, Betances); 9180 kc. (Markuson, Eder). Slogan: "Of Radios Alvarez."

COCO, Havana, Cuba, 12,000 kc., relays CMCF, 10:15-12 midnight, 6010 kc. (Welper, Diez, Mesorana, Scala). Address: P. O. Box No. 98.

COJK, Camaguey, Cuba, 8665 kc., relays CMJK, weekdays, 7:45-10 p.m. (Welper, Alfred, Harley); 8720 kc. (Diez); daily 6-10:30 p.m. (Dressler, Fleming, Shamleffer). Slogan: "Radio Zenith." Address: Finlay No. 3 Altos.

COCD, Vedado, Cuba, 6130 kc., daily 11 a.m.-11:30 p.m., Sunday 11 a.m.-9 p.m. (Scala). Slogan: "La Voz Del Aire."

Readers Who Are Awarded "Honorable Mention" for Their Work in Connection with This Month's Short-Wave Report

MORTON MEEHAN, Robert Pinkerton, Ralph C. Sullivan, Herman Ruppert, P. J. Van Os, S. F. Gallagher, Harry Kentzel, R. C. Messer, William T. Murray, Erroll R. Birnie, H. Westman, Charles F. Myers, P. L. Stiles, Raymond Hernday, John Lindeberg, Sydney Millen, Fred Atherton, Bill Lander, Charles Ford, E. M. de Cottignies, H. Wickens, Sherwood Espenschild, Frank Sakely, Sr., C. W. Chadwick, Thomas Fallon, Jr., George M. Fleming, Mil. M. Pavlovitch, Donald G. McKenzie, Jose E. Mesorana, L. G. Pairman, Heinz Pankow, Clarence M. Meyers, William D. Adkins, Bob Carroll, Kenneth Dressler, Anton J. Cindel, Manuel Betances, M. J. Markuson, Edward J. Margrie, Leslie Mott, Frank Sekach, Robert McCue, J. Wendell Partner, Charles Pierce, Harold E. Lindner, A. M. Rheiner, Gilbert L. Harris, G. H. Allison, Oscar Westman, Leslie Maxwell, Vincent M. Poll, H. B. Sargent, Gustave A. Magnuson, R. F. Shamleffer, N. C. Smith, Carl & Anne Eder, Eric Gertenbach, Peyton Black, Elmer Duncan, Arthur B. Coover, Renato Brossa, C. R. Wilson, Luis Diez, William Beard, Enrico Scala, Jr., A. W. Brummund, H. Mallet-Veale, Warren D'Orsay, William W. Oglesby, Jr., Burnell Unger, James Nigh, Jr., E. Geneve, G. H. Russell, William Dean Noyes Eric W. Watson, D. Summers-Smith, P. L. Patrick, D. A. Harley, Jr., Troy Welper, Fred W. Alfred.

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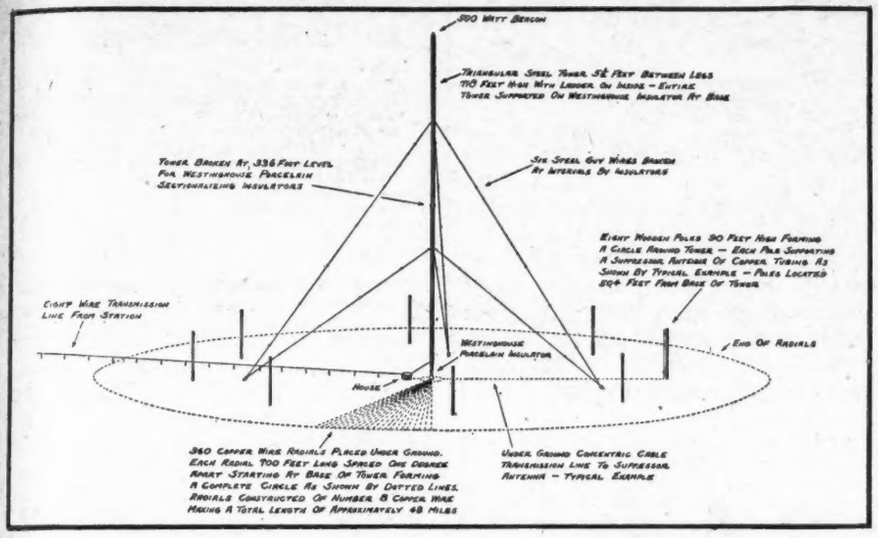
17 Years of Broadcasting

(*Continued from page* 393)

strong enough to support the weight of the steel plus about 20 tons additional load added by the pull of the guys. The main insulator, though only three feet high, has been tested to withstand loads of more than 100 tons. About half-way up the spire, three smaller sectionalizing insulators have been inserted to break the antenna, electrically, at a height of 336 feet. Insulators are also inserted in the guy wires to eliminate radiations from this source or the conducting of current to the ground.

Completely insulated from the ground, the steel spire becomes charged with static during storms, then crackles and sparks continuously. Such electrical phenomena have no effect on its broadcasting efficiency. To improve the conductivity of the ground around the antenna 50 miles of copper wire have been buried a foot under the surface, radiating out, one degree apart, for 700 feet. The vast efficient ground system so formed aids in reducing the effect of skywave emissions.

An eight-wire radio-frequency line sends the output of the transmitting station to a tuning house near the base of the antenna. From this point



four power lines run up inside the spire carrying radio frequency and current for a brilliant aviation beacon at the tip as well as four riding lights installed along its sides.

Last year (October 30, 1937) when erected to a height of 644 feet, the original vertical antenna buckled and fell. Since that time extensive testing has been given all the new parts for the new spire to ascertain their ability to support the unusual strains and loads induced. Guy wire attachments are set in concrete piers 400 feet from the base of the antenna. Two sizes of wires are used, that supporting the top section being one-inch cable pre-stretched and tested to 52,000 pounds; the lower guys of seven-eighths inch cable tested to 41,000 pounds. The top guys connect to the tower at the 526-foot level and the lower guys at 270 feet. Forged steel turnbuckles, used to tauten the wires, are strong enough to withstand pressures exerted by 100,000-pound pulls.

The bottom steel antenna section is shaped as an inverted triangle with a squared-off tip. This tip, less than eighteen inches wide, forms the peg on which the 718-foot structure sits and permits it to sway slightly under stress. A concrete pier, 10 feet wide, deep in the ground, provides the supporting foundation.

The welded steel sections of the antenna are built of straight round bars with smaller round spacing bars placed at angles forming V's. Partially stream-lined by these round members, loads caused by wind pressure are minimized.

Engineers will operate the sky-scraping radiator at three-quarters of a wave-length, thus establishing a new record for efficiency as all prior vertical types have been limited to a maximum electrical length of five-eighths of a wave-length. Transmitting efficiency increases directly as the electrical length of the antenna is extended.

Electrically, the antenna is split in the middle by its sectionalizing insulators to cause an even distribution of current. Normally, current reverses itself every half wavelength but by feeding different voltages to the upper and lower sections the current flows in the same direction throughout the length of the spire.

Though now the highest welded structure in the world—nothing is close to it in slim height—the antenna was erected in 72 working hours by a crew of nine men. Its top beacon and lightning rod would be level with the roof of the Radio City building in New York whence come many of the NBC network programs broadcast by KDKA.

Free Code Instruction

New York, N. Y.—Under the auspices of the New York City Board of Education free code instruction is offered to prospective amateur and commercial operators. The course is conducted Monday to Thursday evenings, 7:30 to 9:30 p. m. at the Harlem Evening Trade School, 138th Street and Fifth Avenue, New York City.

550 Kc.

Washington, D. C.—The F.C.C. has announced a new policy in regard to licensing broadcast stations on 550 kc. so as to avoid interference with naval communications. No station will be licensed for greater power than 1 kilowatt at night or 5 kilowatt in daytime on this frequency. Applications for new stations or increase in power in locations less than 300 miles from the coast must be accompanied by written approval of the Navy Department. No new station or increase in power or time will be granted in zones between 300 and 500 miles from the coast without approval of the Navy Department. The above mileages may be increased or decreased so as to insure that a signal strength of not more than 100 microvolts per meter will result at the nearest coast or point of naval communications activities.

Set Tester

(*Continued from page* 405)

plus 2.5 ohms) or 350 ohms. The sectional values in the 50-ohm shunt are calculated by multiplying the total "ring resistance" (350 ohms) by the full-scale current of the meter (0.001 ampere), dividing the result by each range value in turn from the common terminal and subtracting the sum of the preceding values from each newly determined value.

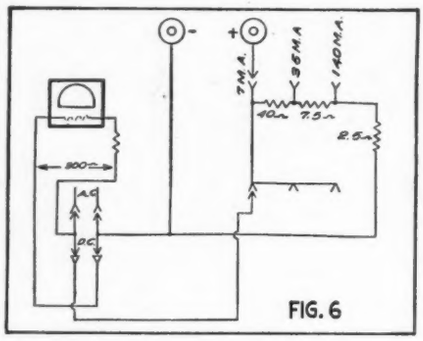


FIG. 6

By multiplying 350 by 0.001 ampere, we get a value of 0.35 into which each range, in turn, is divided. Dividing 0.14 (140 ma.) into 0.35 gives us a value of 2.5 ohms for our first resistor. Dividing 0.035 (35 ma.) into 0.35 gives us a value of 10 ohms from which we subtract 2.5 ohms, the value of the 140 ma. range resistor, leaving 7.5 ohms as the value for the second resistor. The third resistor is the difference between 10 ohms and 50 ohms or 40 ohms.

INDEX TO ADVERTISERS

The DX Corner

(Broadcast Band)

(*Continued from page 433*)

1370	WABY	All night
1410	WAAB	All night
1460	KSTP	to 3:00 a.m.
1500	WJBK	All night

Observer Routzahn adds the following stations in the all night category: WIND, 560 kc, and WEXL, 1310 kc.

New Zealand Changes

Observer Watson of New Zealand writes that 3ZB at Christchurch is now on the air on 1430 kc., using 1 kw. power. 4ZB of Dunedin is also now on the air on 1220 kc. with 1 kw. 3ZM is off the air.

Japanese List

Observer Randolph Hunt submits the latest list of JO's. Many of them he has personally checked. An asterisk beside the frequency of a station indicates that a Japanese station has been heard by Observer Hunt on that frequency. An asterisk following the call letters indicates that he has definitely identified the stations during recent weeks.

Kc.	*Call*	*Location*
580	JFCK	Taichu, Taiwan
*590	*JOAK1	Tokyo
*600	JONG	Miyazaki
*610	JOJK	Kanazawa
630	JOKK	Okayama
640	JODG	Hamamatsu
650	JOUK	Akita
*670	JOTK	Matsuye
*680	JOVK	Hakodate
*690	JOBK1	Osaka
*700	*JOCG	Ashigawa
710	JODK1	Keijo, Korea
720	JORK	Kochi
720	JFBK	Tainan, Taiwan
*730	JOCK1	Nagoya
*740	*JOSK	Kokura
*750	*JFAK	Taihoku, Taiwan
*770	JOHK	Sendai
*780	*JOPK	Shizuoka
*790	JOGK	Kumamoto
*810	JOIK	Sapporo
*820	*JBBK2	Heijo, Korea
*830	JOFK	Hiroshima
*850	JBCK	Seishin, Korea
*870	JOAK2	Tokyo
*890	*JOLG	Tottori
*910	JOLK	Fukuoka
*920	JOQK	Niigata
*930	*JOAG	Nagasaki
*940	*JOBK2	Osaka
950	JOOG	Obihiro
*970	JODK2	Keijo, Korea
*980	JOXK	Tokushima
*990	JOCK2	Nagoya
1000	JOBG	Maebashi
*1020	*JOFG	Fukui
1030	JBAK	Fusan, Korea
1040	JONK	Nagano
*1050	JOHG	Kagoshima
*1060	JOIG	Toyama
1070	JOOK	Kyoto
1080	JOJG	Yamagaya
1090	JBBK1	Heijo, Korea

Amateur Observer

(*Continued from page 439*)

3ZB-8, 4HG-6, 4HJ-6, 4LX-7, 4RF-8, 5LL-8, 5WR-7, 6CA-5, 7DH-7, 7KR-7, 7LZ-7, 7YL-7, VP1AA-9, 1RB-8, 5ST-9, YN-AA-8, YU1XX-6, ZL1BC-7, 1DV-7, 1LZ-7, 1LM-7, 1MR-8, 2CI-7, 2DS-7, 2GN-8, 2PM-8, 2QA-7, 4AC-7, 4GM-5, ZS1AN-7, ZU2G-7, 2B-7, 6E-7.

20 meter phone: CN8AM-6, EA8AE-8, 9AH-7, FA3HC-7, K6NZQ-8, 6OQE-8, SM7YA-7, SU1CH-8, VK2ADA-7, 2VV-5, 4JU-6, 5JS-8, VO1I-9, 1P-8, 2N-9, 2Z-9, 6L-9, VP2AT-8, YU7XX-6, OX2QY-8.

By Clarence Hartzell, 1 N. 6th Street, Overbrook, Jeannette, Pa.

10 meter phone: G2KH-6, 6BW-6, 6DL-5, 6GO-4, 6DH-7, 6BJ-8, F3CX-6, 8HL-5, GM6RG-9, ON4SD-5, EI9J-8, J6AK-7, PAOUV-6, ZS1AY-5.

20 meter phone: G2AL-6, 2DP-5,, 2MK-7, 2ML-6, 2RH-4, 2AV-5, 5RJ-6, 5CM-4, 5IK-7, 6AW-5, 6LS-7, GW6KY-4, CT3AN-5, CN8AA-4, 8MO-3, A8L-6, PAOAA-5, OFB-6, OTI-4, VO6D, KA1OR-3, 1AL-4, VK2WH-3, 2OK-7, 2NO-5, 2IJ-4, 2DK-5, VK3WA-5, 3VW-6, 3RA-4, 4WO, ZS3A-5, SM5SD-7, VP7NA-6, TI3RE-6, LU1CA-9, 2CA-5, 5BZ-7, PK1MX-5, 2WL-3, YV5ABD-9, 5AD-7, 5AI-8, PY2AK-6.

By Chris Davis Jaffe, Algonquin Park, Norfolk, Va.

10 meter phone: K5AT-7, 6MVV-5, VK2GU-7, GM6RG-9, G2PU-6, LHQ-5, 5ML-9, 6GF-6, ZS6AJ-6, PAOFB-7, ZU6P-7, ZT6A-4.

20 meter phone: EA9AH-9, CN8AM-9 8AJ-5, 8AL-6, ZT5P-8, 6Y-4, ZS5AB-7, ZU1T-6, 6N-7, ZE7JB-5, FR8VX-3, SU1GD-5, OQ5AA-5, G2MF-6, 2ML-6, 2PU-7, 5NI-9, 5ML-9, 5JO-5, 5TP-6, 5SP-7, 5BM-8, 6IA-6, 6XR-9, 6GF-5, 8MX-7, 8LP-6, HA8N-6, ON4VK-6, 4SS-5, PAOMQ-5, EI2L-8, 3J-4, YL2BA-5, F3KH-6, 8XT-5, CT1PC-6, XU8MC-5, VS1AI-6, 1AA-7, XW6A-6, PK1JJ-7, 1VN-4, 2AE-5, 2ABD-7, 2RJ-7, 2HF-5, 3AL-6, 6MU-8, OX2QY, W10XAB.

By Homer Bohlender, R. R. 2, Brookville, Ohio.

10 meter phone: VK2GU-6, K6MVV-8, ZE1JR-6, 1JY-6, GM6RG-6, G2IT-5, 2KU-7, 5VM-7, 5BM-6, 5AU-6, 5KH-7, 6GF-6, 6BW-7, 6DH-7, 6GO-6, 6VX-6, 6LL-7, 6WY-7, 8FZ-6, GW2UL-7, ZT6J-6, 6Y-5, 6AK-6, ZS6AH-6, 6T-6, F3LH-6, 3KH-7, 8LX-6, EI2L-8, NY2AE-7, LU7AG.

20 meter phone: VK2VV-6, 2HS-7, 2BQ-7, 2UC-8, 2ADU-6, 2TC-7, 2NO-7, 2AZ-8, 2CP-5, 2QI-5, 2AFQ-7, 2ADE-6, 2OG-7, 2IQ-6, 2AP-7, 2MH-6, 2VB-6, 2BK-6, 2DK-6, 3MX-7, 3WD-7, 3ZZ-6, 3KR-8, 3RE-8, 3KX-7, 3XJ-8, 3ZL-7, 3NP-6, 3GQ-6, 3CE-6, 3BZ-6, 4VD-7, 4JU-8, 4JX-6, 4BB-7, 5DC-7, 5AC-7, 6MU-6, 6WS-6, K6OQE-8 6KMB-8, 6MXM-8, 6BNR-8, 6MZK-7, YV4AB-7, 4AX-7, 4AF-7, 5AG-8, 5AK-8, 5AM-7, 5AA-6, 5ABF-6, 5ABQ-7, G5ML-8, 5TZ-7, 5NI-7, 5SP-6, 5BJ-7, 6XR-8, 6DT-6, 6BW-6, 6OL-6, 6JF-7, 6AI-7, 8MX-6, 8IX-6, HC1FG-8, 1JB-7, ZU6P-7, ZS2N-6, 2X-6, 3F-5, 6S-7, F3IX-6, 3OO-7, 8KW-6, 8PW-6, EI2L-7, NY2AE-7, CN8AJ-8, LU1QA-6, 1HI-6, 7AC-6, 8AB-5, 9BV-7, OA4C-6, OA4AL-7, VO6L-7, 6D-7, HK1EP-7, 3JB-6, 4AG-6, PY5AQ-6, EA9AH-8, VP7NA-7, CT1AY-7.

By Ray Bayer, 2814, La Salle Street, Racine, Wisc.

20 meter c.w.: CX2BK-5, D3CSC-4, 4BFU-5, F8KW-8, FA8DA-5, FY8B-3, G2MA-3, 2ZY-8, 5YH-4, 6JZ-4, 6RO-6, 8BD-7, HC1JW-6, I1IR-4, K5AA-8, 5AC-9, 5AE-7, 5AG-6, 6OKN-6, 7BOE-5, LU2EG-5, OA4J-4, OE1FH-5, OH5OA-4, ON4GK-7 4KM-4, 4RX-6, OX2OY-7, OZ7UU-3, PY2AC-3, SAH-5, U1AD-3, 2NE-5, 3BC-3, VK2ADE-5, 2DG-4, 2QE-6, 3IW-5, 3MR-6, 4JX-8, 5LL-6, 5RV-4, 5WR-4, 7YL-5, YM4AA-3, YN1AA-5, YU7XX-3, YV2CU-3, ZL1HY-6, 1MR-4, 2CI-5, 2QA-3, ZS1ANI-3, ZU6U-4.

20 meter phone: HH2B-5, HK1EP-6, 3HA-8, LU4BA-5, K6OQE-7, 6NZJ-6, NY2AE-9, OA4AI-5, 4C-5, SU1CH-6, 1SG-6, SM5SVp4, TI2KP-9, 2OFR-6, 3RE-6, OX2QY-7, VO6D-7, VP9R-7, VK2AC-3, 3KX-4, YV4AA-5, 5AB-4, 5ABF-6, 5AK-4.

By Burnell Nnger, 525 Frederick Street, Hanover, Pa.

20 meters: TI7LF-5, NY2AE-7, K6OQE-6, OX2QY-7, UP3BG-7, VO6I-5, G5NI-8, HK3MD-5, YU3AM-5, 3AA-8, 4FS-5, 5AE-4, 5AA-3, 5AK-7, HJ1AP-6, 3MP-4, VK2AXQ-2, 2VV-4, 2MU-3, 2CE-4, 2AR-3, 4BG-3.

Home-Made Speaker Cement

A quick-drying radio cement can be easily made at a small cost by mixing equal quantities of collodion and banana oil. Experimenters will find this cement not only useful for speaker repairs but also successful for coating r.f. coils, chokes, etc. In an emergency, liquid nail polish can be used as a radio cement but its cost is prohibitive for big jobs. When storing the cement be sure it is kept in an air tight can or bottle. Collodion can be purchased at most drug and hardware stores.

HAROLD MILLEN
Roxbury, Mass.

NEXT MONTH

Experimenters who are interested in building a receiver that will give them High-fidelity reception on the Broadcast band will be interested in Mr. Adams' receiver to be described in February.

At Your Dealer's

(*Continued from page* 435)

made for easy and quick installation. The aerial is constructed of wide, semi-rounded strips to afford signal pickup. Flowing arrow-like lines and the highly polished finish of the antenna make it harmonize nicely with the new cars.

Using the Slide Rule for Radio Calculations

Many radio experimenters will appreciate the following pertinent information taken from the "Aerovox Research Worker" on the use of the slide rule for radio calculations. Due to the limited space in this department it will not be possible to give the entire data in the one issue; simple examples showing short-cuts in ordinary multiplication and converting wavelength to frequency are outlined in this first composition, to be followed in subsequent issues of the magazine with equations, involving vacuum tubes, alternating current bridges, power dissipation, etc.

There is no doubt that the slide rule enables one to solve mathematical equations speedily and with sufficient accuracy. Yet it is not being used as much as it might be and its full possibilities are seldom utilized. This surprising condition is probably due to a lack of familiarity with short cuts and a lack of practice in using the rule. Very often the product of three factors and even more, can be found by a single setting of the slide while the average man will probably change settings two or three times.

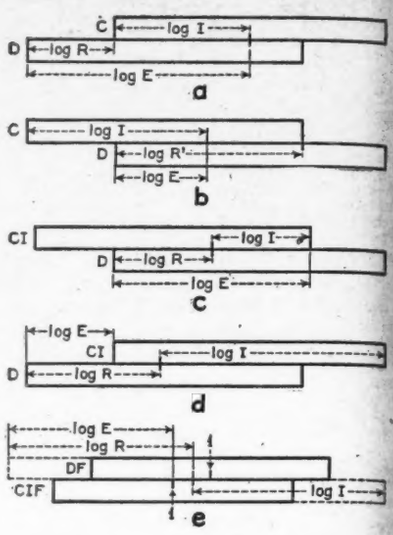
This article aims to show the quickest way of obtaining solutions to typical equations employed in the radio art. This is not intended as an elementary text on the use of the slide rule; it is assumed that the reader is familiar with his rule and that he is able to perform the usual computations. It is merely intended to show applications to radio since this field of endeavor never seems to be covered in instruction books.

The question arises: What type of rule appears the most suitable? The examples below will illustrate that considerable time can be saved by the use of folded and inverted scales. Rules having the inverted, folded and inverted-folded scales are the "polyphase-duplex" and the "log-log-duplex." Some work requires log-log scales and trigonometric scales. However, in order to be of universal aid, the following instructions will apply to the "polyphase-duplex" scale and special hints will be given for the benefit of those who have rules with an inverted scale but without folded scales. Such a rule is the "polyphase." The identification of each scale on the rule will be by letter, familiar to all who possess a slide-rule.

Ohm's Law

$$E = IR, \quad I = E/R, \quad R = E/I$$

If I and R are given, the result can be obtained in several ways. The first one is illustrated in Figure 1a. This is ordinary multiplication using the C and D scales. Figure 1b shows the solution for the case when E would fall beyond the limits of the D scale. An alternative way of obtaining the same result is by means of the inverted scale CI and the D scale. This is illustrated in Figures 1c and 1d. Set I on scale CI to R on scale D and read E at either the right or left index of CI on scale D. In some cases this would result in drawing the slide nearly completely out of the stock. It is in such cases that the folded scales serve



admirably. For the sake of accuracy and speed the slide should always remain at least half-way in the rule. Whenever the use of scales C or D or CI and D would require a greater movement of the slide, it will be found that the same problem can be solved using CF and DF or CIF and DF without having to move the slide too far. As an illustration, the case of Figure 1d is shown again using scales CIF and DF, Figure 1e. Also, in the case of Figure 1a, when E falls beyond the limit of the scale D, if folded scales are provided it is not necessary to reset the slide to the position of Figure 1b. Instead, find I on scale CF and opposite this mark the answer, E, is found on DF.

In all examples of Ohm's law when E is given together with R or I it will be found most expedient to employ the settings of Figure 1c or 1e. It should be noted also that in certain problems, where it is required to find the current for several different values of resistance across the same voltage, all the answers can be found at a single setting. This would not be true if the settings of Figures 1a and 1b were used; this is the advantage of inverted scales.

Converting Wavelength to Frequency

Employing the polyphase slide rule, set the left index of CI to 3 on D. Then find the wavelength corresponding to any frequency on D opposite the frequency on CI or vice versa. This one position of the slide is sufficient to solve all possible conversions from frequency to wavelength and vice versa.

The polyphase-duplex slide rule enables one to employ a folded scale; then the slide need not be moved so far. Set 1 on CIF to 3 on D, then the corresponding values of wavelength and frequency are found opposite each other on the CIF and the D scales. It is also possible to use the CI and DF scales, setting 3 on CI to 1 on DF.

Smart Kink for Tagging Resistors

Checking back a number of old fixed resistors, I found it very difficult to determine their value due to the fading and chipped enamel; and of course the accumulation of dirt was no help. To reclaim these units, their resistance was checked on an ohmmeter and the values written on a small piece of adhesive tape which was pasted around the resistor. I found this a worthwhile kink for quickly determining the values of resistors. I am applying this tag idea to new resistors as well.

WM. CHALMERS
Chicago, Illinois.

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